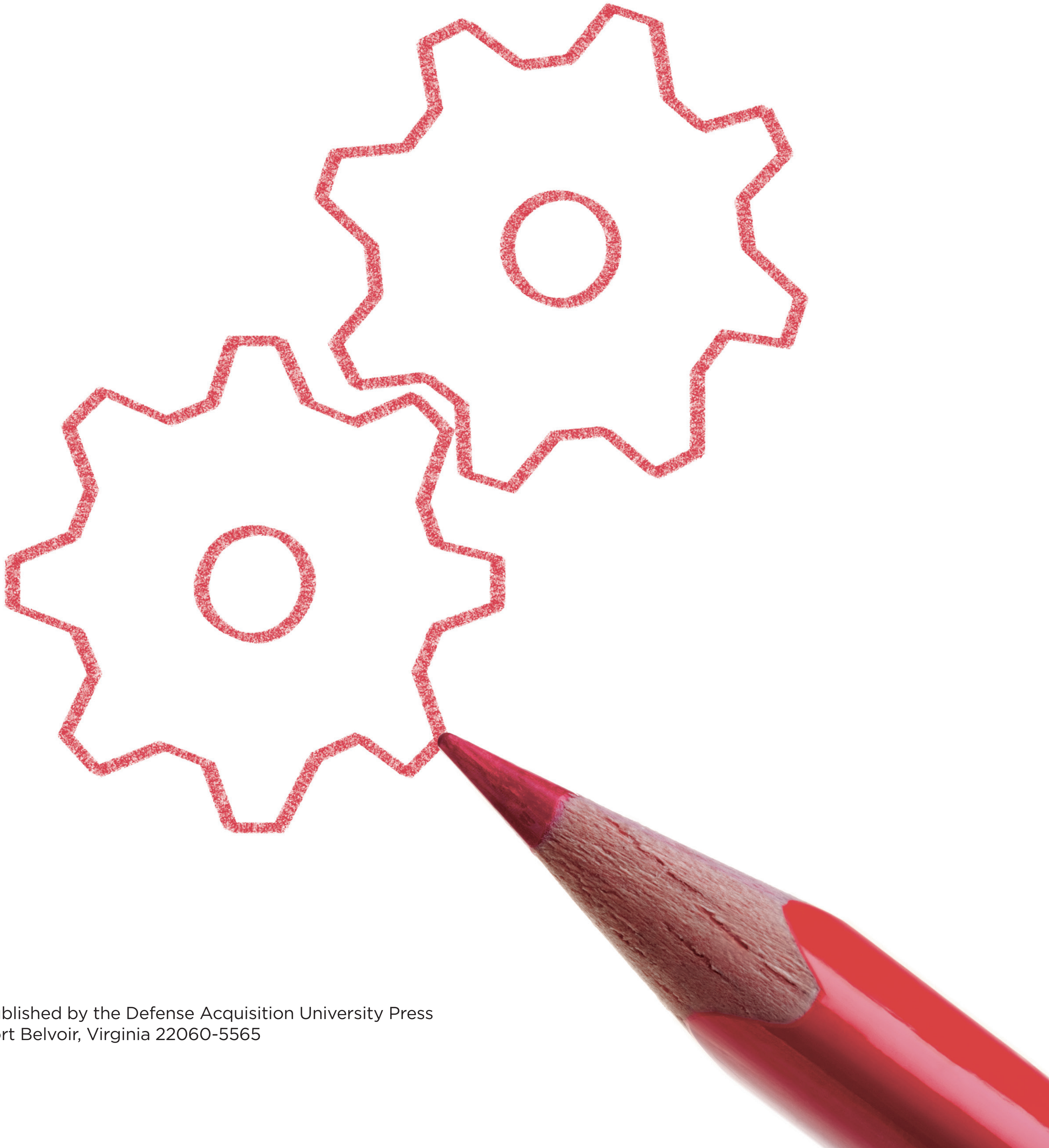
Defense Acquisition University

LOG 201 Student Guide | 2013



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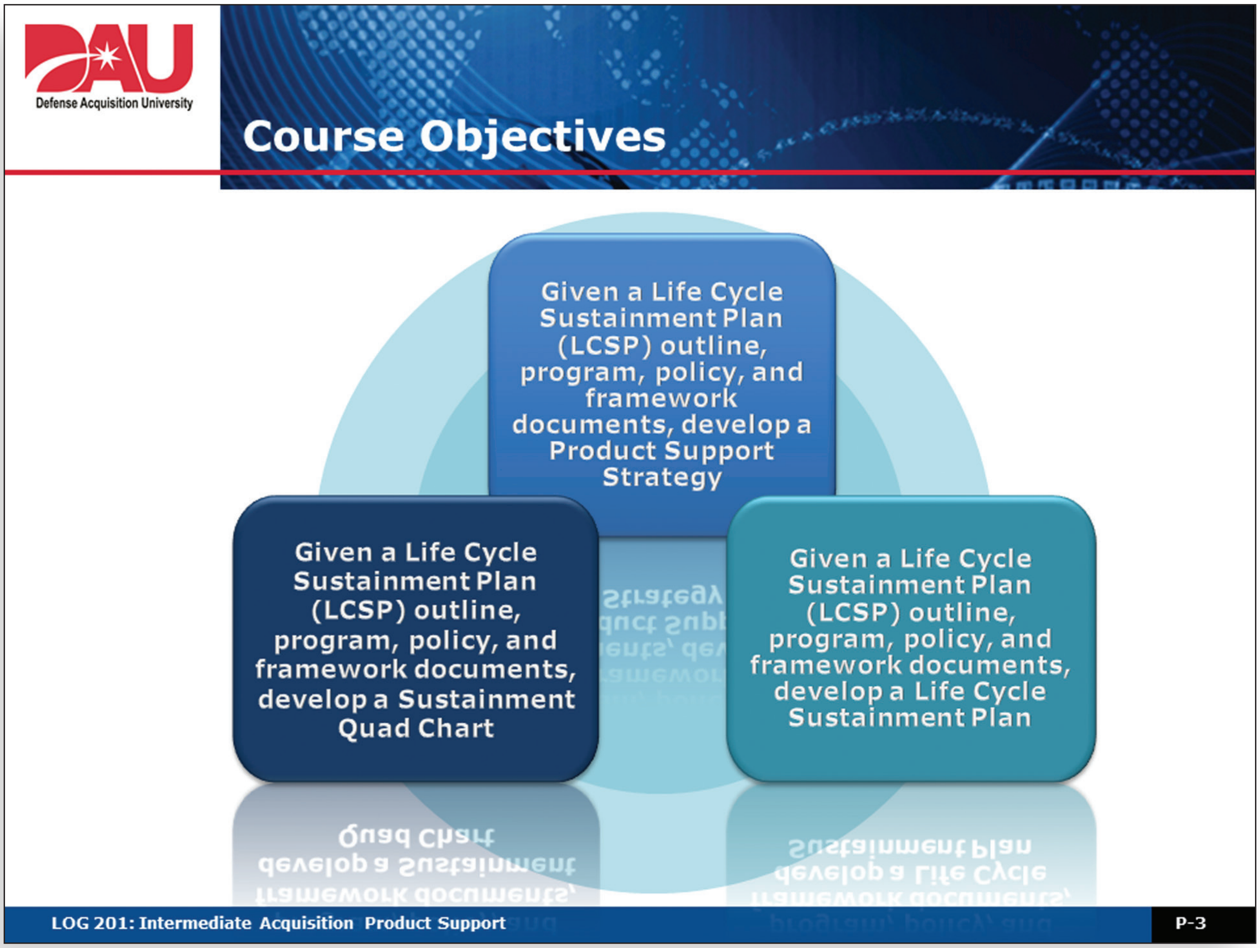
Administration—Course Introduction

Course Objectives:

Given a Life Cycle Sustainment Plan (LCSP) outline, program, policy and framework documents, develop ...

- a Product Support Strategy
- a Life Cycle Sustainment Plan
- a Sustainment Quad Chart



Schedule:

Instructors and Administration Contact Information:

Name: ____________________ Name: ____________________

Phone: ____________________ Phone: ____________________

Email: ____________________ Email: ____________________

Name: ____________________ Name: ____________________

Phone: ____________________ Phone: ____________________

Email: ____________________ Email: ____________________

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Schedule

	Monday	Tuesday	Wednesday	Thursday	Friday
AM	Course Introduction Beginning the Product Support Strategy	Technology Development and Logistics Risk	Reliability and Performance	Building the Sustainment Quad Chart	Reality Check Brief End of Course Survey
PM	Strike Talon CONOPs, Requirements and Product Support Strategy	Maintenance Concept and Planning	Reliability and Affordability	Reality Check	

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Emergency Numbers:

Fire: ______________________________

Police: ______________________________

Weather: ______________________________

Classroom Building Number: ______________________________

Classroom Number: ______________________________

Classroom E-mail Address: ______________________________

Academic Freedom and Nonattribution:

- ____________________ in the spirit of learning, but do it ________________.
- You can say you heard it here, but do not directly attribute any comments to ________________________.

Course Rules:

The Three P's

1. ______________________________ .
2. ______________________________ .
3. ______________________________ .

Lesson 1-1

Beginning the Product Support Strategy

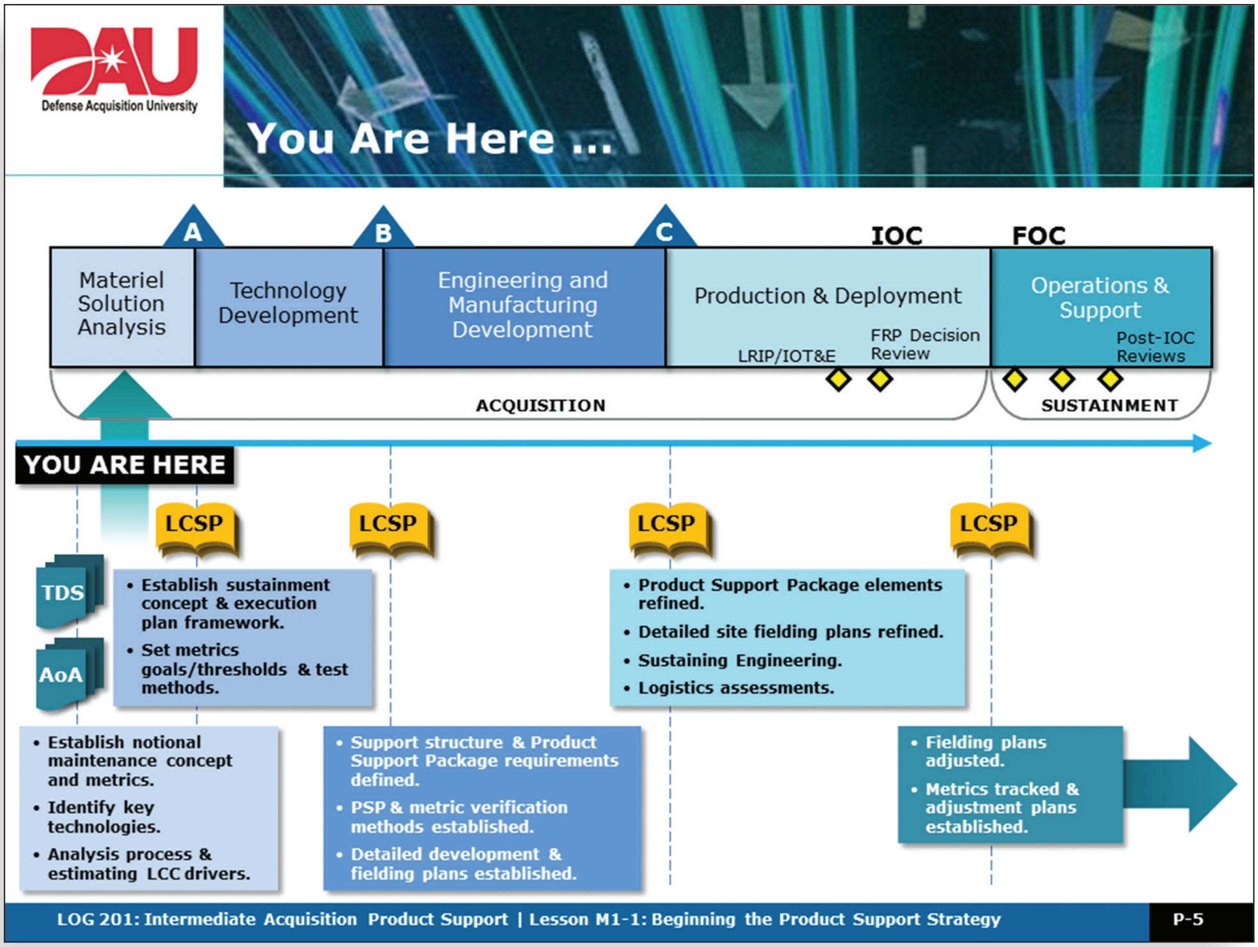
Lesson Objectives:

- Given material from previous courses, program, policy, and framework documents, identify warfighter requirements.
- Given material from previous courses, program, policy, and framework documents, assess effect of warfighter requirements on the Product Support Strategy.
- Given program, policy, and framework documents, identify boundaries, constraints, opportunities, and design considerations affecting the life cycle logistician and Product Support Strategy.

What's In It for Me?

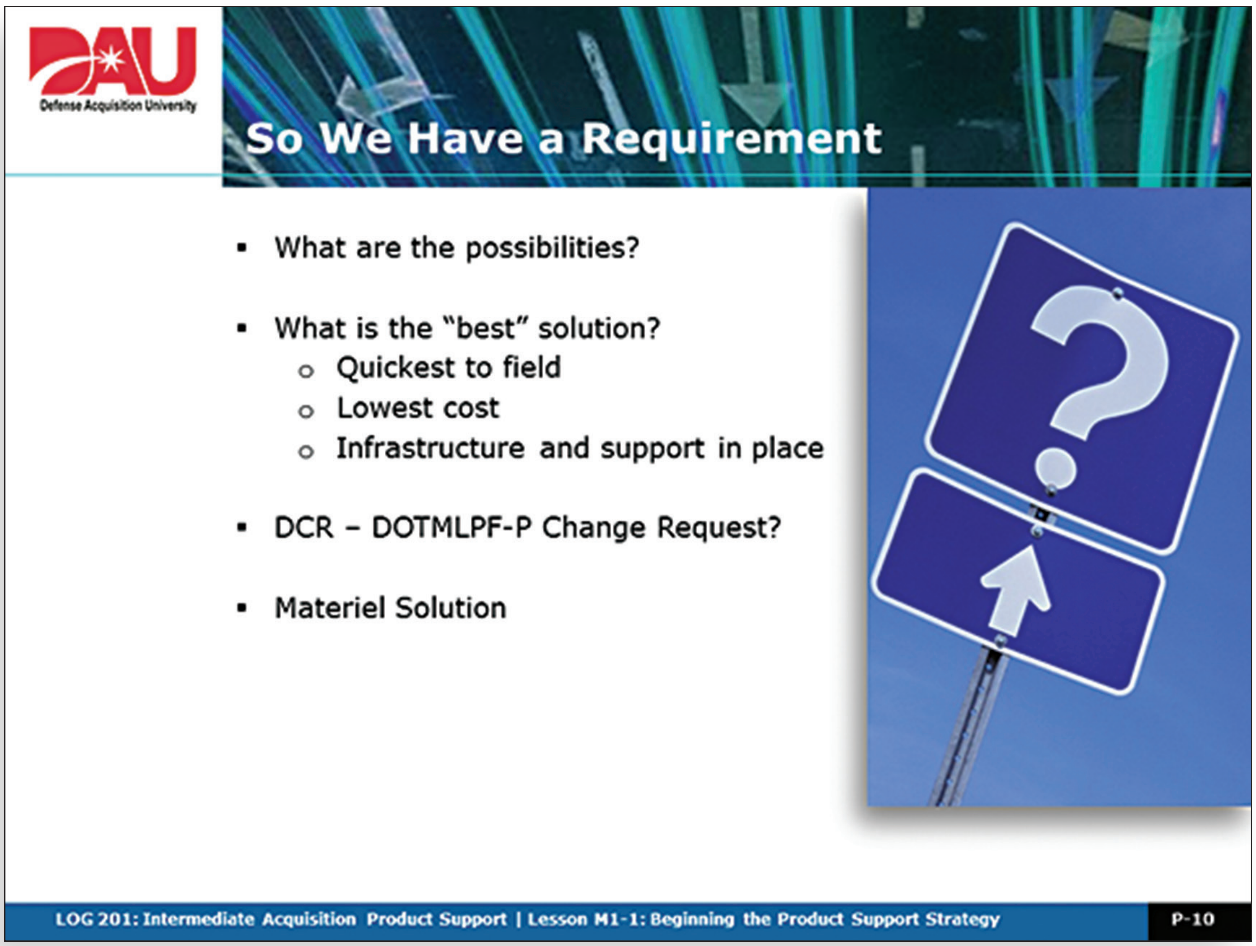
- You will understand warfighter requirements and how they affect the Product Support Strategy.
- You will describe Concept of Operations and its effect on the Product Support Strategy.
- You will describe and evaluate boundaries and constraints for a Product Support Strategy.
- You will understand why you must consider design and how it affects the Product Support Strategy.
- You will understand what drives the initial formulation of your Product Support Strategy.

We will start each class by identifying where we are in the life cycle, especially with regard to the Life Cycle Sustainment Planning process. We will use this as a guide throughout the course as we "build" our Life Cycle Sustainment Plan for the Strike Talon Unmanned Combat Aircraft System (UCAS).



Notes:

First things first … we are in the initial stages of identifying the best approach for meeting the warfighter's capability requirements. However, it is very important for the logistician to be involved. Understanding the requirements, from the beginning helps shape our Product Support Strategy and gives us the opportunity to ensure that support considerations are taken into account. But not all requirements become materiel solutions.

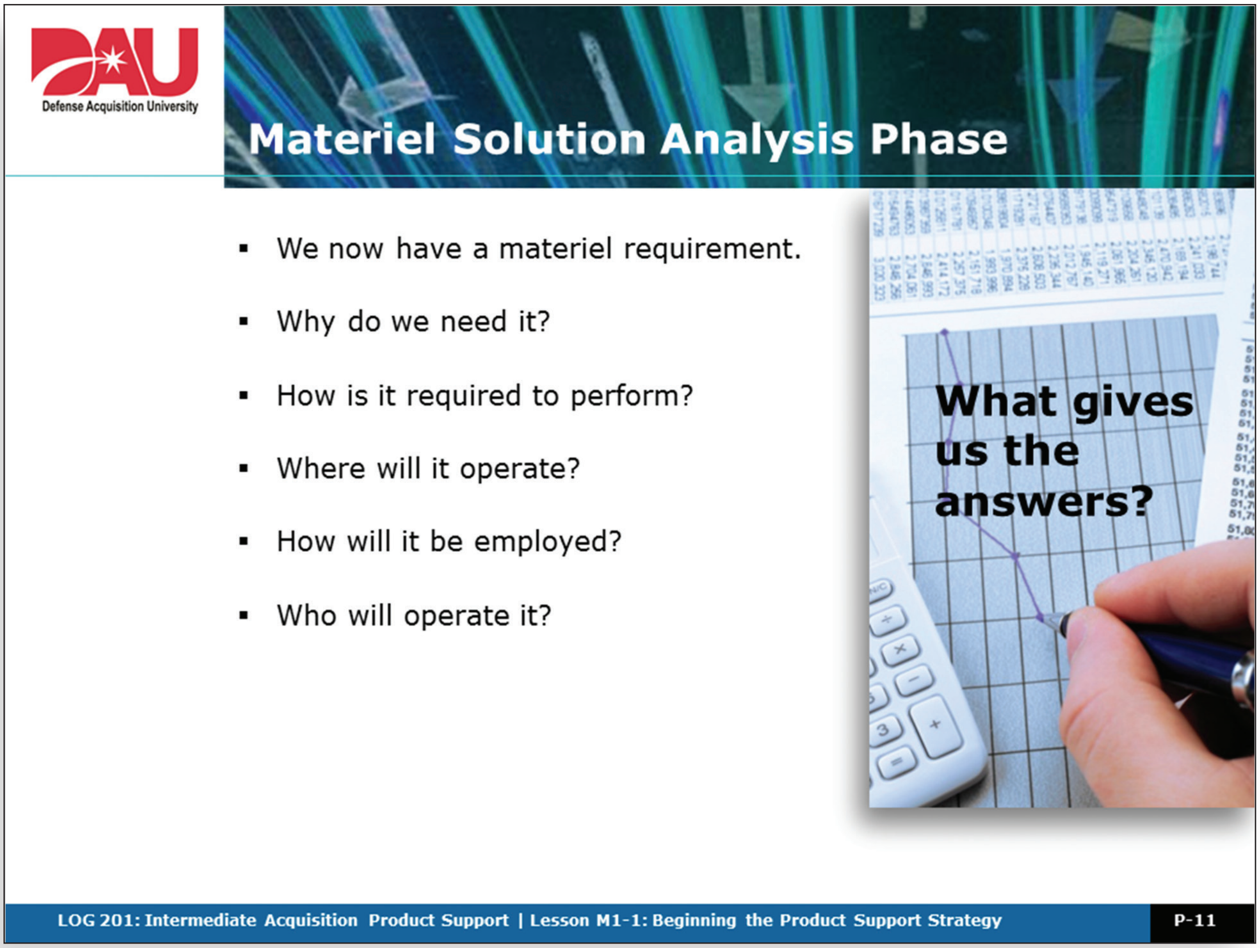


DOTmLPF-P is an acronym for the following:

- Doctrine
- Organization
- Training
- Materiel
- Leadership & Education
- Personnel
- Facilities

Notes:

When it is determined that no other approach will meet the warfighter's requirement except a materiel solution, we begin the materiel solution process.

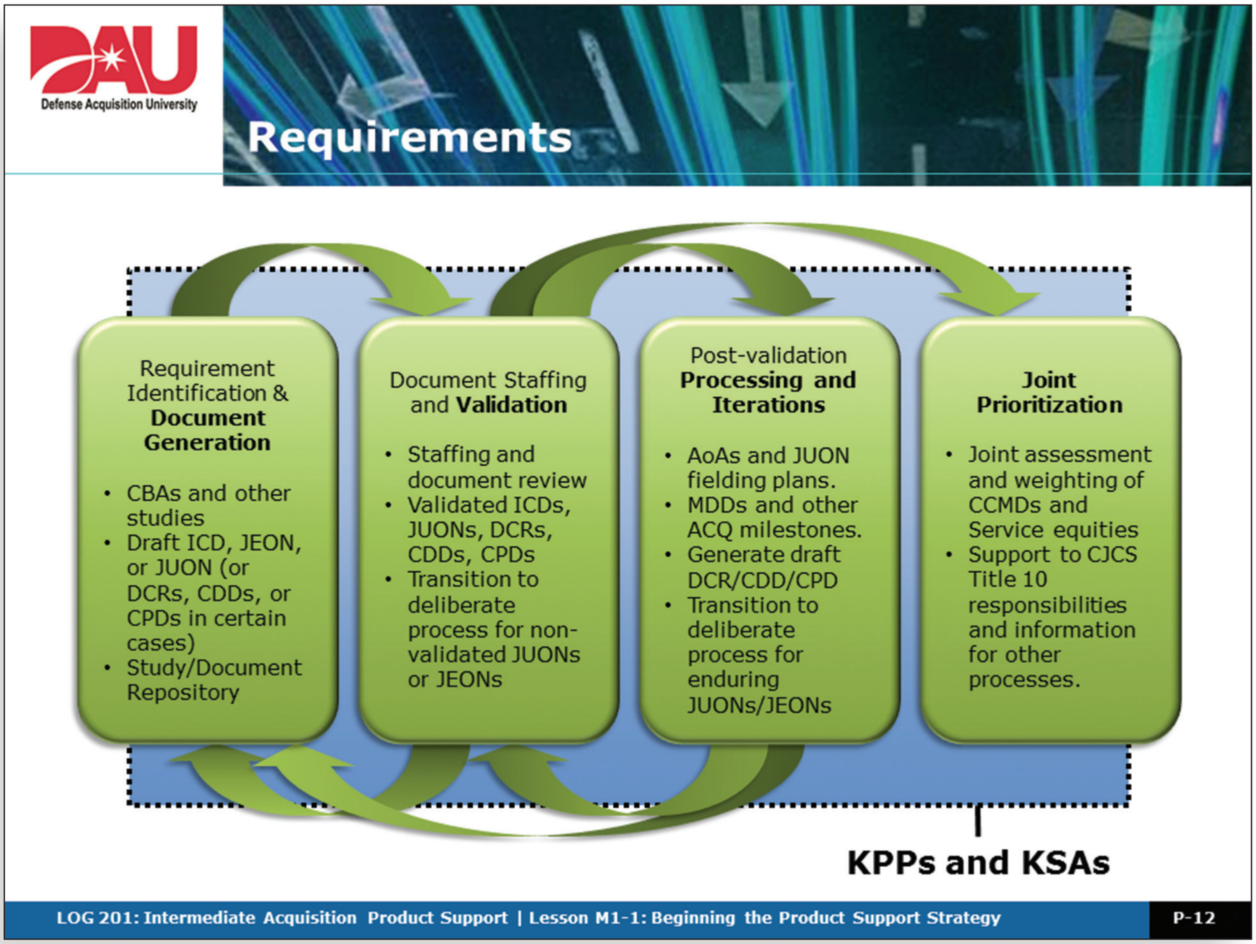


Notes:

Requirements:

Policy—What guides this process?

KPPs and KSAs—Key Performance Parameters and Key System Attributes



Definition of KPP:

KPPs are those system attributes considered __________________ for an effective military capability.

Failure to meet a KPP threshold may result in ________________________________ of the program or a modification of the production increments.

Definition of KSA:

KSAs are system attributes considered most critical or essential for an effective military capability, but ________________________.

KSAs provide an additional ____________________________ below the KPP but with senior sponsor leadership control (generally 4-star level, defense agency commander, or principal staff assistant).

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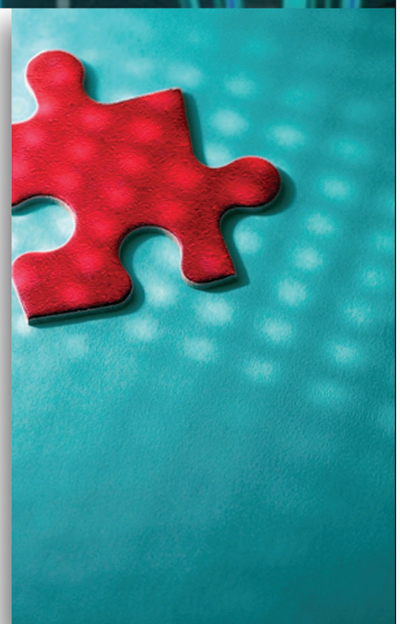
Concept of Operations (CONOPS)



CONOPS

Definition—as described in CJCSI 3170 JCIDS series

- CONOPS are written to describe how a joint force commander may organize and employ forces in the near term (now through 7 years into the future) in order to solve a current or emerging military problem. These CONOPS provide the **operational context** needed to examine and **validate current capabilities** and may be used to **examine new and/or proposed capabilities** required to solve a current or emerging problem.

Key terms in definition

- Provide operational context (why does LCL need to know and understand?)
- Validate current capabilities (what about this is helpful to an LCL?)
- Examine new and/or proposed capabilities (what do we want to know about this?)

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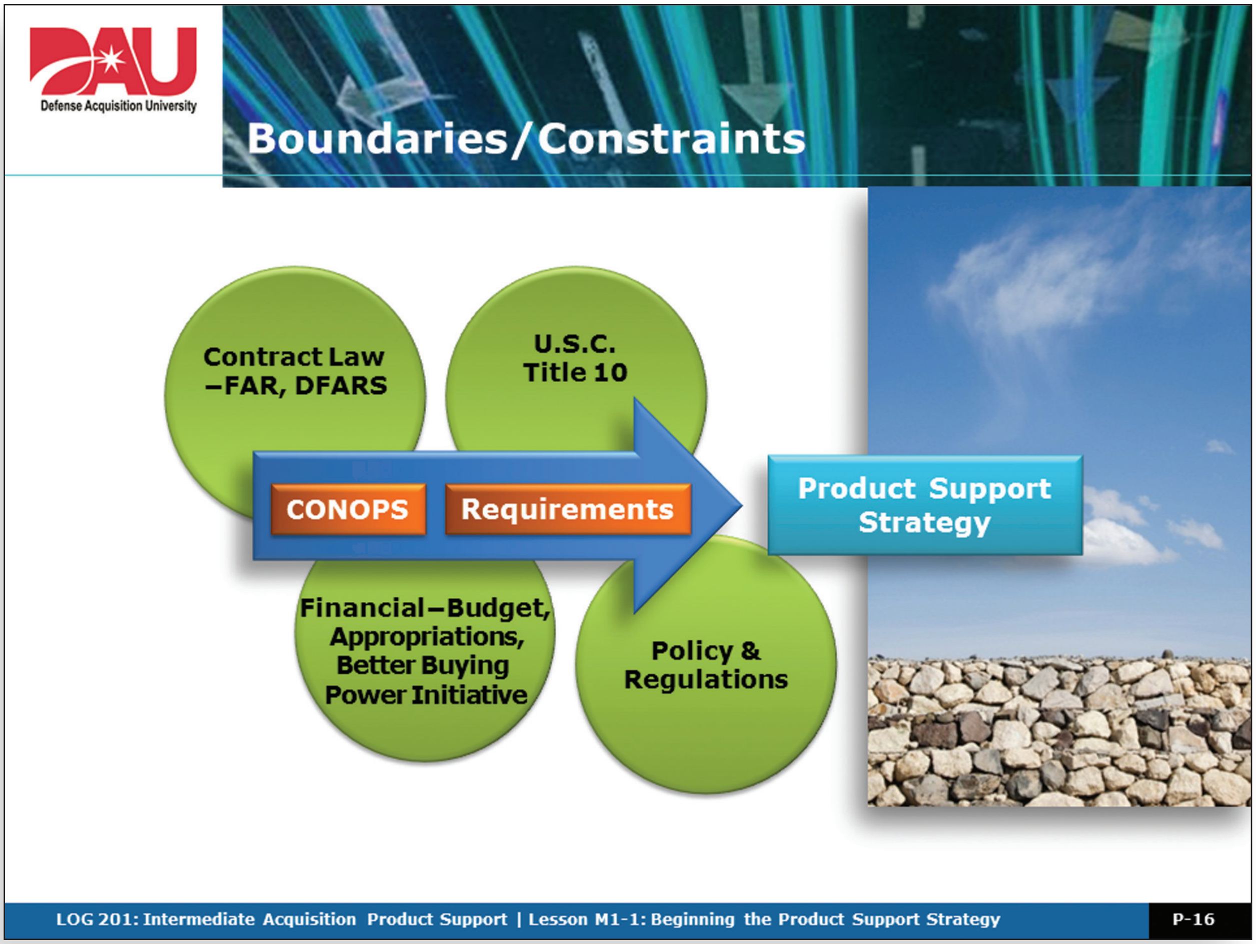
Provide operational context. (What do those working in Life Cycle Logistics (LCL)—the logisticians—need to know and understand?)

Validate current capabilities. (What about this is helpful to an LCL?)

Examine new and/or proposed capabilities. (What do we want to know about this?)

Boundaries and Constraints:

- Contract Law—Federal Acquisition Regulation (FAR) and Defense Federal Acquisition Regulation Supplement (DFARS)
- Financial
  - Budget—Planning, Programming, Budgeting, and Execution System, and Better Buying Power Initiative
  - Appropriations
- Policies
- Law—Title 10 U.S. Code



Section and Title	Summary
2464—Core Depot-Level Maintenance and Repair Capabilities	DoD must maintain a government-owned, government-operated core depot-level maintenance and repair capability. SecDef identifies the capabilities and workload required. Includes capabilities necessary to maintain and repair weapon systems and other military equipment (including mission-essential weapon systems or materiel) not later than 4 years after achieving initial operational capability. Now requires annual congressional review (report), and initial assessment required for Milestone A decision.
2466—Limitations on Performance of Depot-Level Maintenance (50-50)	Not more than 50 percent of the funds made available in a fiscal year to a military department or a defense agency for depot-level maintenance and repair workload may be used to contract for the performance by nonfederal government personnel. Collected, monitored, and reported at Service level. Milestone Decision Authority must certify that a determination of applicability of core depot-level maintenance and repair capabilities requirements has been made before a Major Defense Acquisition Program (MDAP) may receive Milestone A approval.
2474—Centers of Industrial and Technical Excellence: Designation; Public-Private Partnerships	Designate each depot-level activity of the military departments and the defense agencies as a Center of Industrial and Technical Excellence in the recognized core competencies of the designee. Secretary designating a Center may authorize and encourage the head of the Center to enter into public-private cooperative arrangements.

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Better Buying Power Initiative

- Target affordability and cost growth
- Incentivize productivity and innovation in Industry
- Reduce nonproductive processes and Bureaucracy
- Promote real competition
- Improve tradecraft in acquisition of services

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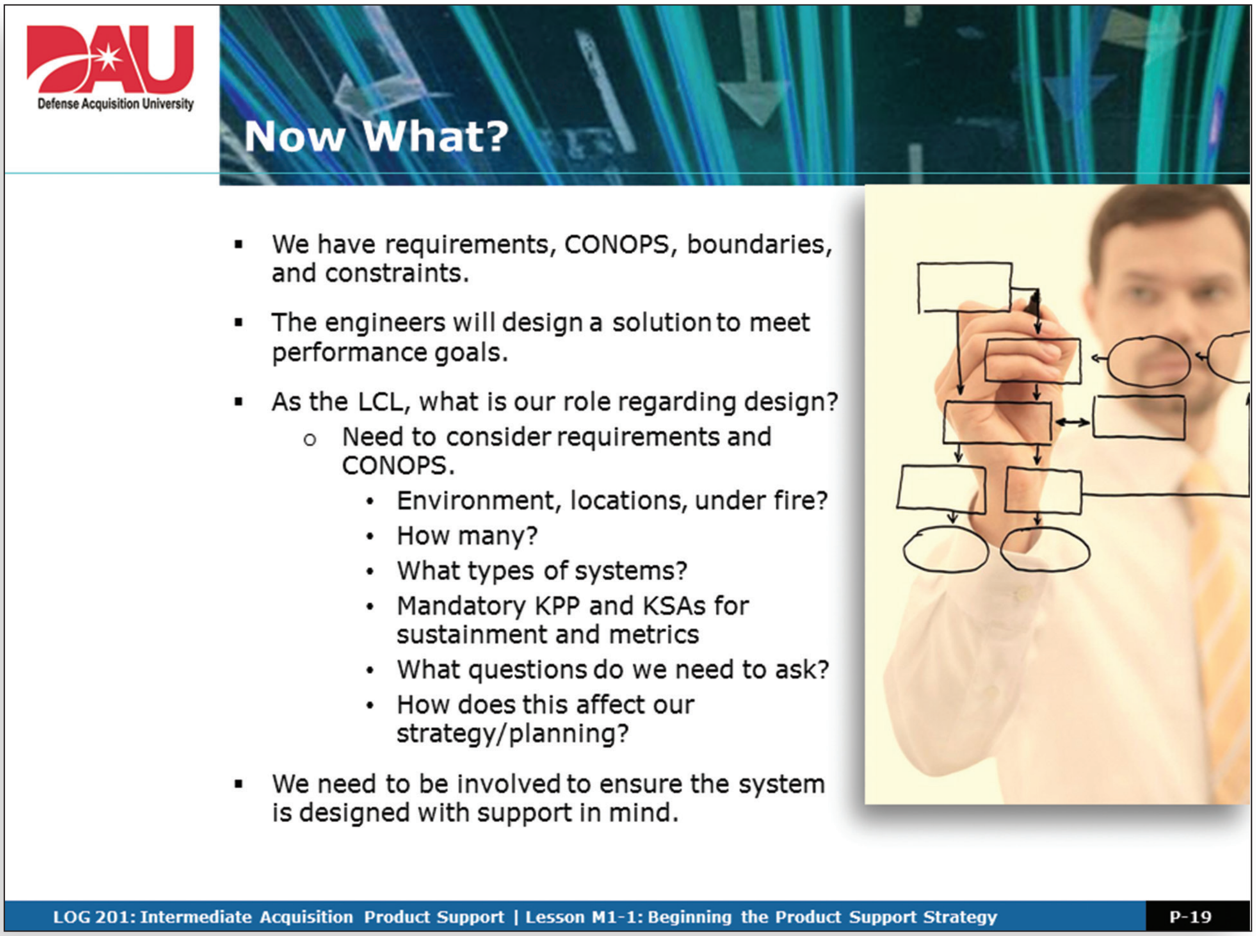
Notes: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Now What?
▪ We have requirements, CONOPS, boundaries, and constraints.
▪ The engineers will design a solution to meet performance goals.
▪ As the LCL, what is our role regarding design?
o Need to consider requirements and CONOPS.
• Environment, locations, under fire?
• How many?
• What types of systems?
• Mandatory KPP and KSAs for sustainment and metrics
• What questions do we need to ask?
• How does this affect our strategy/planning?
▪ We need to be involved to ensure the system is designed with support in mind.
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Design:

- Design for ________________________________.
- Design the ________________________________.
- Support the ________________________________.

Design FOR Support

- **Role of Life Cycle Logistician**
  - Be involved in design planning.
  - Influence the design to ensure supportability.
- **Once designed, many of the support costs are locked in.**

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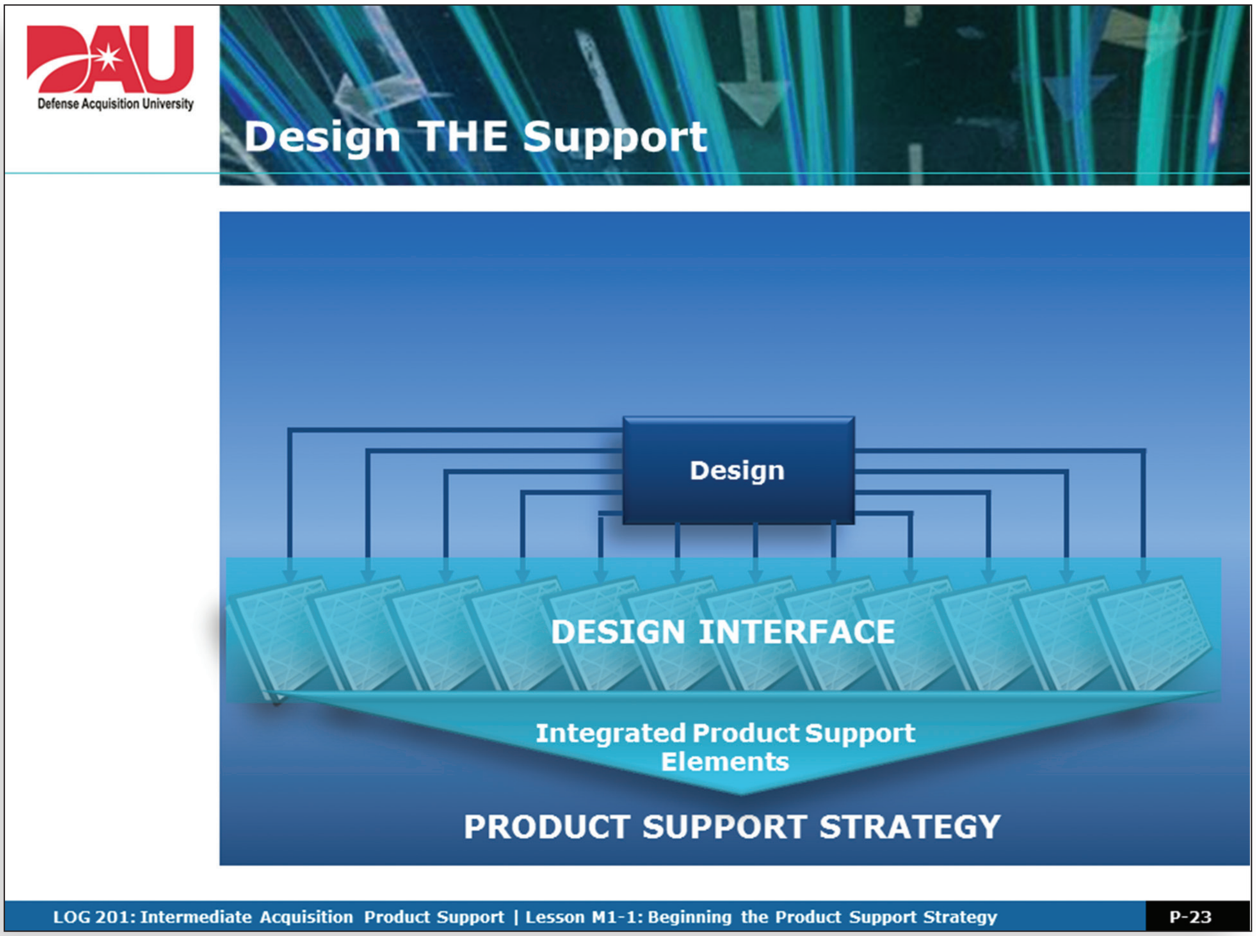
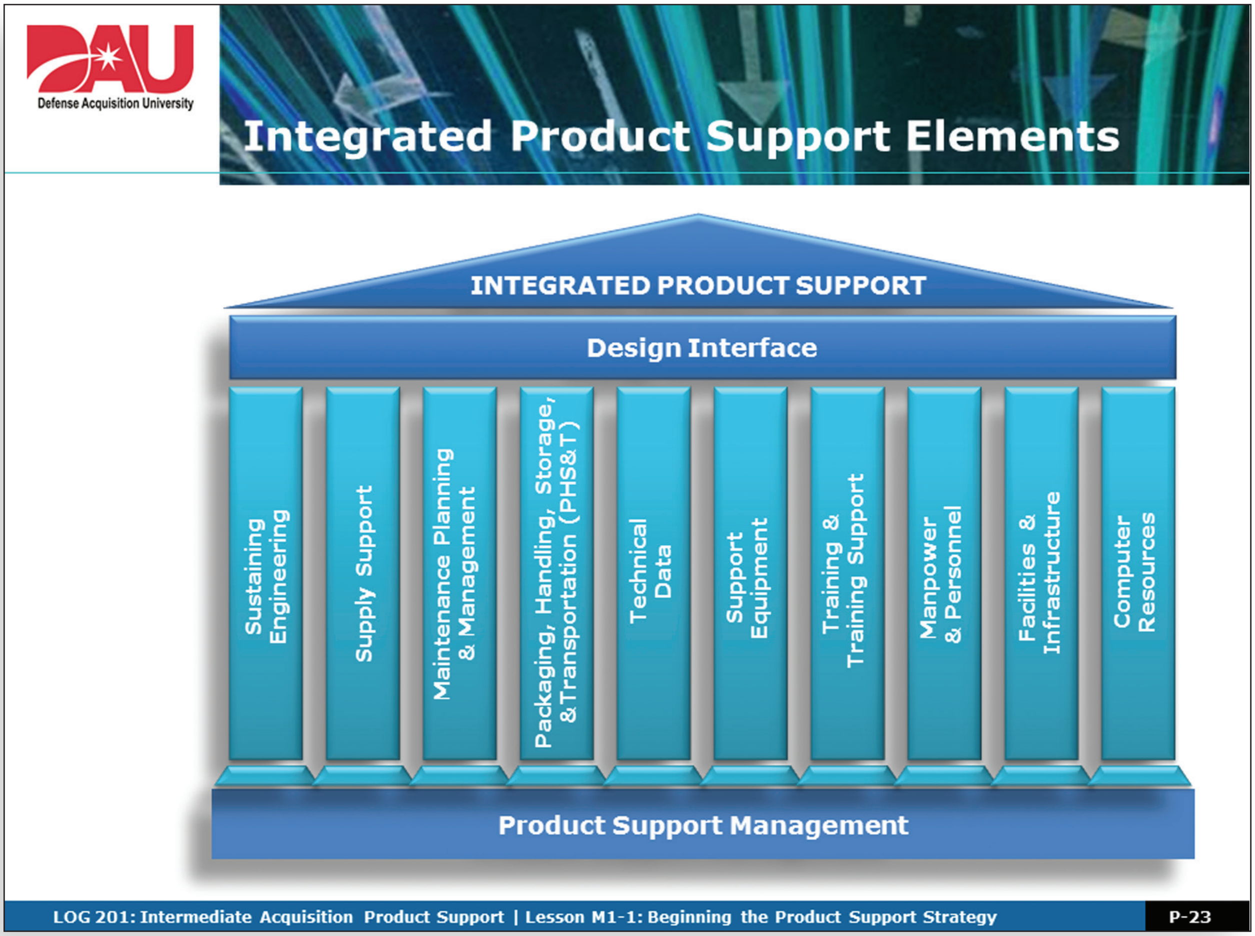
Notes:



To evaluate and build a Product Support Strategy, we must evaluate the system design, while considering our boundaries and constraints. The approach for doing this is "filtering" the design through the Integrated Product Support Elements. This is known as DESIGN INTERFACE.

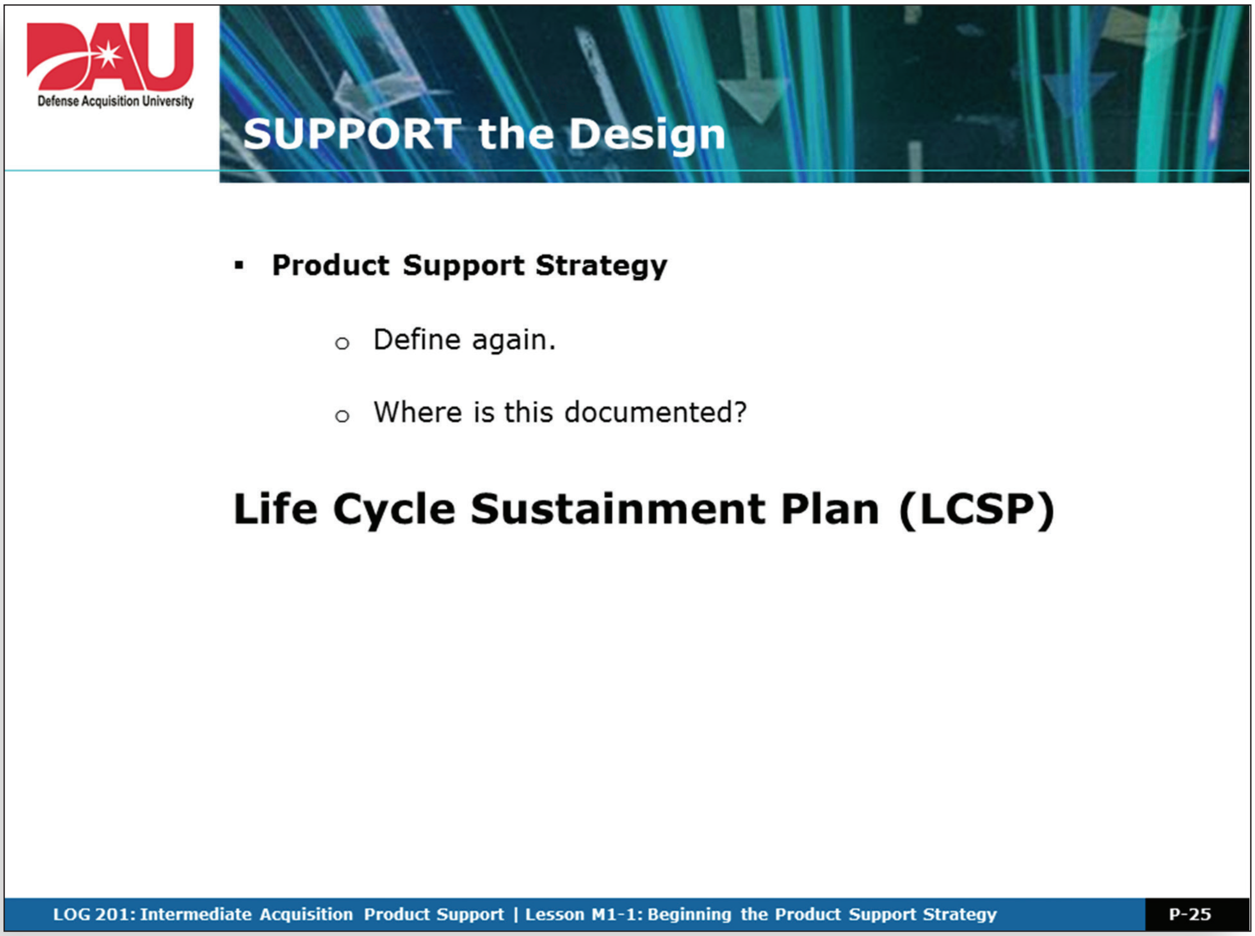


There are 12 Integrated Product Support Elements (IPS elements). We must consider each and their effect on the other 11—an integrated approach. This method will help us build an inclusive Product Support Strategy. It requires horizontal thinking—we must not focus solely on one functional area. We must understand how decisions for one element affect the others.

For example, deciding what is to be maintained, who does maintenance, and where it is done affects the number of personnel required, the training they need, tools, technical data, facilities, and spare parts. Your approach also includes balancing and trading off the benefits to the costs across the range of IPS elements. The following pages provide definitions and basic information about each IPS element.

See the Reading Section for more details on the IPS elements (excerpt from the *IPS Element Guidebook*).

Notes:



Student Exercise

(See p. 31 in the Exercise 1 section for instructions.)

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Takeaways

- **Warfighter Requirements**
  - Capability needed, and performance goals we must achieve.
- **CONOPS (Concept of Operations)**
  - Tells us where, when and under what conditions we will support.
- **Boundaries and Constraints**
  - Tells us how we can support.
- **Affordability**
  - Tells us what it "will cost" while working to reduce costs ("should cost").
- **Design**
  - Tells us the design we need to support.
- **IPS Elements**
  - Links requirement, CONOPS, boundaries/constraints and design to support strategy.
  - We must consider affordability.
- **LCSP**
  - Where we document our Product Support Strategy.

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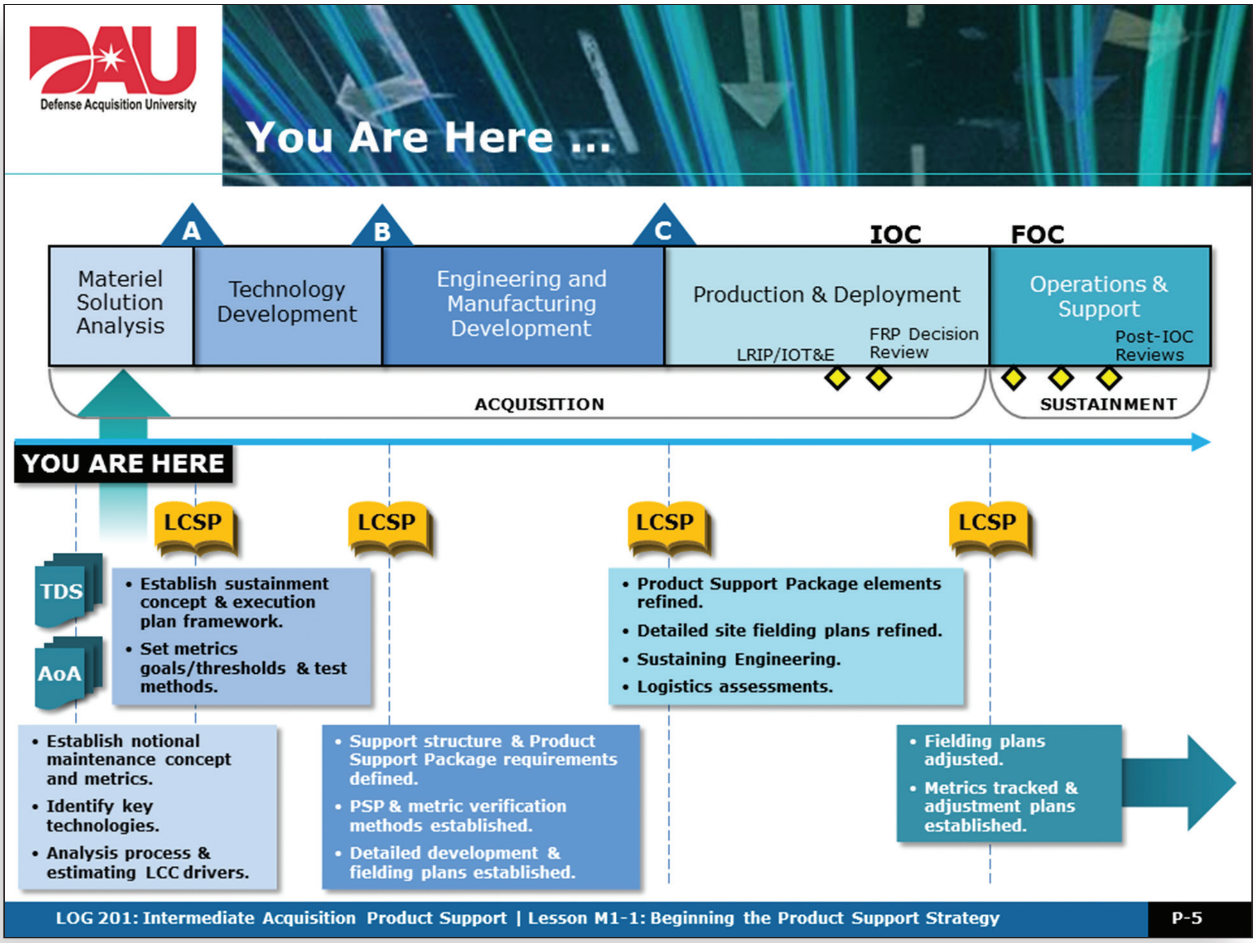
Notes:



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You Are Here ...
A
B
C
IOC
FOC
Materiel Solution Analysis
Technology Development
Engineering and Manufacturing Development
Production & Deployment
Operations & Support
LRIP/IOT&E
FRP Decision Review
Post-IOC Reviews
ACQUISITION
SUSTAINMENT
YOU ARE HERE
LCSP
LCSP
LCSP
LCSP
TDS
AoA
• Establish sustainment concept & execution plan framework.
• Set metrics goals/thresholds & test methods.
• Product Support Package elements refined.
• Detailed site fielding plans refined.
• Sustaining Engineering.
• Logistics assessments.
• Establish notional maintenance concept and metrics.
• Identify key technologies.
• Analysis process & estimating LCC drivers.
• Support structure & Product Support Package requirements defined.
• PSP & metric verification methods established.
• Detailed development & fielding plans established.
• Fielding plans adjusted.
• Metrics tracked & adjustment plans established.
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P-5

Notes:

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Summary

- You now understand warfighter requirements and how they affect the Product Support Strategy.
- You can describe CONOPS and its effect on the Product Support Strategy.
- You can describe and evaluate boundaries and constraints for a Product Support Strategy.
- You understand why you must consider design and how it affects the Product Support Strategy.
- You understand what drives the initial formulation of your Product Support Strategy.

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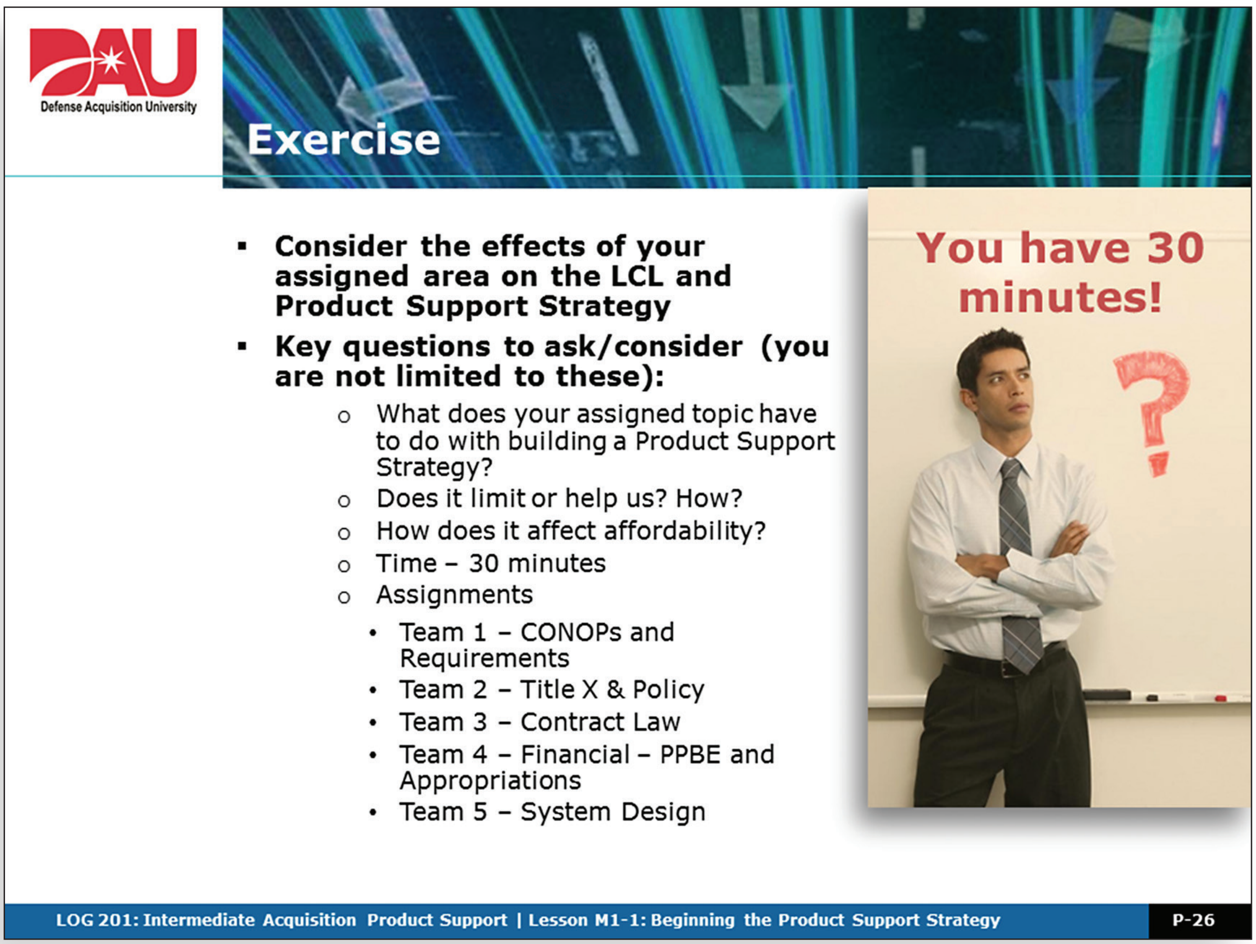
Notes:

Lesson 1-1 Exercise

This exercise's focus

How do outside influences affect our Life Cycle Sustainment Plan development? Each team is assigned a topic. Each team will generate a list of challenges, constraints, and opportunities associated with its assigned area and its connection to Life Cycle Sustainment Planning. In other words, what does the assigned topic have to do with us? Why do we care? Does it limit or help us, and how? Teams will record their ideas and brief their results to the entire class. You will be provided 30 minutes to prepare your brief. Five (5) topics will be covered.

They are listed below:



Some helpful background information to use in preparing your briefings for the class

CONOPS and Requirements

Warfighter requirements are provided through a capabilities-based process known as the Joint Capabilities Integration and Development System (JCIDS). This process is governed by CJCSI 3170.01H. The output of this process, for materiel solutions, is the system requirements. This is what the system must be able to do, how it needs to function, and what capabilities it must have to carry out the CONOPS. How fast does our system need to fly/steam/drive? How far does it need to go? What is the required capacity (personnel, weapons, sensors)?

As we've discussed in class, the CONOPS is the what, where, when, why, and how of employment for the system. Knowing what the system must be capable of doing and how it will be employed (environment, basing, frequency of operations) drives the product-support planning process.

To illustrate these points, let's look at a practical example. In determining the right vehicle to buy, you must understand how it will be used. Will you use it to drive to work only? Will you drive it on vacations? How many miles a year will you drive? What type of roads? What will its environmental exposure be (parked outside, in a garage, driven in snow, extreme cold, extreme heat)? How many people will it need to carry? Will it carry cargo? These questions address your concept of operations for this vehicle.

To meet the CONOPS, you must then have specific performance requirements, such as horsepower, gas mileage, interior capacity, exterior capacity, towing capacity, etc. These, stated in objective terms, are your requirements.

Understanding the general concept of CONOPS and requirements, evaluate and answer the questions for the exercise.

Title 10 and Policy

Title 10 of the U.S. Code establishes the United States Armed Forces. Part 146, Section 2460 defines Depot-Level Maintenance. Sections within 2460 define opportunities and limitations to Depot Level Maintenance and Repair functions. The table on p. 17 of your *Student Guide* (and below) summarizes the main sections of Title 10.

Table 1:—Title 10 Section Summaries

Section and Title	Summary
2464—Core Depot-Level Maintenance and Repair Capabilities	DoD must maintain a government-owned, government-operated core depot-level maintenance and repair capability. SecDef identifies the capabilities and workload required. Includes capabilities necessary to maintain and repair the weapon systems and other military equipment (including mission-essential weapon systems or materiel) not later than 4 years after achieving initial operational capability. Now requires annual congressional review (report), and initial assessment required for Milestone A decision.
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2474—Centers of Industrial and Technical Excellence: Designation; Public-Private Partnerships	Designate each depot-level activity of the military departments and the defense agencies as a Center of Industrial and Technical Excellence in the recognized core competencies of the designee. Secretary designating a Center of Industrial and Technical Excellence may authorize and encourage the head of the Center to enter into public-private cooperative arrangements.

Contract Law

Contract Types: The Federal Acquisition Regulation (FAR) provides a wide variety of contract types for use by the DoD in the procurement of products and services. These contact types vary according to:

- The degree and timing of the responsibility assumed by the contractor for the costs of providing products and/or services
- The amount and nature of the profit incentive offered to the contractor for achieving or exceeding specified standards or performance goals

The contract types are grouped into two broad categories: cost-reimbursement and fixed-price. The specific contract types range from cost-plus-fixed-fee, in which the contractor has minimal responsibility for the performance costs and the negotiated fee (profit) is fixed, to firm-fixed-price, in which the contractor has full responsibility for the performance costs and resulting profit (or loss). In between are the various incentive contracts, in which the contractor's responsibility for the performance costs and the profit or fee incentives offered are tailored to the uncertainties involved in contract performance. The acquisition strategy identifies the type of contract planned and the reasons it is suitable, including considerations of risk and reasonable risk-sharing by the government and the contractor(s). The specific contract types within the cost-reimbursement and fixed price contract categories are:

- Cost-Reimbursement Contracts
- CPFF (Cost-Plus-Fixed-Fee)
  - › Basically reimburses contractor for level of effort work accomplished plus a reasonable profit
  - › Used when cost and pricing risk is immature (usually very early in the life cycle

- CPIF (Cost Plus Incentive Fee)
  - Objectively assessed performance metrics
  - Used early in program when metric baseline is immature
- CPAF (Cost Plus Award Fee)
  - Subjectively assessed performance metrics
  - Used when baseline maturity allows identification of performance metric values/targets
- Fixed-Price Contracts
- FFP (Firm-Fixed-Price)
  - Used when cost and resource baseline is mature
  - Pricing risk is both understood and minimized (usually later in the life cycle)
- FPIF (Fixed-Price Incentive Firm Target)
  - Objectively assessed performance metrics
- FPAF (Fixed-Price Award Fee)
  - Subjectively assessed performance metrics
  - Award fee earned based on predetermined assessment of contractor performance against an award fee plan

Incentive fee and award fee contracts are both based on monetary incentives. The main difference between an incentive fee and award fee is that the former is based on objectively assessed criteria and the latter is based on subjectively based criteria. As defined in FAR Subpart 16.4, an incentive fee contract includes a target cost, a target profit or fee, and a profit or fee adjustment formula. The formula is based on the contractor's performance (actual costs) relative to the target cost. Award fee contracts can be used when contractor's performance cannot be measured objectively. The amount of the award fee to be paid is determined by judgmental or subjective evaluation of the contractor's performance in terms of the criteria stated in the contract.

Traditionally, cost-plus contracts were viewed favorably pre-Milestone B because of the technological uncertainty at this stage of the program. However, a January 2010 report from the Defense Business Board 5 recommended using fixed-price contracts to the maximum extent possible throughout the acquisition process. The AT&L office has voiced support for a greater use of fixed-price contracts pre-MS B. The report stopped short of prescribing fixed-price contracts but cited the DoDI 5000.02 requirement for written justification whenever fixed price is *not* selected for all major defense acquisition programs (MDAPs). It also cited guidance in the DFARS Part 216.104-70 and Part 216.601 that states the government should use fixed-price contracts when risk has been reduced to the extent that realistic pricing can occur; e.g., when a program has reached final stages of development and technical risks are minimal. Guidance in the FAR Part 16.103(b) and Part 12 were similarly cited.

Another facet of the contracting approach the life cycle logistician must consider is FAR Part 12 vs. FAR Part 15. FAR Part 12, Acquisition of Commercial Items, describes policies and procedures unique to the acquisition of commercial items (note that, as used here, "items" is synonymous with "products and services"). It implements the federal government's preference for the acquisition of commercial items contained in Title VIII of the Federal Acquisition Streamlining Act of 1994 (Public Law 103-355) by establishing acquisition policies more closely resembling those of the commercial marketplace and encouraging the acquisition of commercial products and services. FAR Part 12 requires use of fixed-price type contracts. Use of any other contract type to acquire commercial products and services is prohibited. Commercial items also are exempt from the requirement for detailed cost or pricing data.

Table 2: Fixed Price Vs. Cost-Reimbursement Contracts

Fixed Price	Cost Reimbursement
› Maximum risk sharing between government and contractor. › Contractor has greater incentive to control costs.	› Minimum risk sharing between government and contractor. › Government pays allowable costs incurred by the contractor.
› Use when support requirements and resources are well defined (i.e., mature baseline).	› Use when support requirements and resources are not well defined (i.e., immature baseline).
› Fixed, Award, or Incentive Fee may be used. Metrics related to performance, schedule, and/or cost	› Fixed, Award, or Incentive Fee may be used. Metrics usually based on cost targets
› *FAR Part 12 or 15	› *FAR Part 15 only
› Minimizes administrative burden on government and contractor.	› Increases administrative burden on government and contractor.

***FAR Part 15**, (Contracting by Negotiation) pertains to policies and procedures governing competitive and noncompetitive negotiated acquisitions. A contract awarded using other than a sealed bidding procedure is a negotiated contract. All contract types and fee types are allowed under FAR Part 15. Table 1 provides a summary of the key elements of fixed-price and cost-reimbursement type contracts.

Financial—PPBE

Background (From teaching note of Siobhan Tack and ACQuipedia):

The **Planning, Programming, Budgeting, and Execution (PPBE)** process is the DoD internal process for allocating resources to capabilities deemed necessary to accomplish the Department's missions. One output of PPBE is the funding proposed for inclusion in the **President's Budget (PB)** submitted to Congress. The ultimate objective is to provide Combatant Commanders (COCOMs) with the optimal mix of forces, equipment, and support attainable within established fiscal constraints.

PPBE evolved from the Planning, Programming, and Budgeting System (PPBS), introduced into DoD in the early 1960s by Secretary of Defense (SecDef) Robert McNamara. PPBS established the framework and provided the mechanisms for resource-driven decision making impacting the future, and provided the opportunity to annually reexamine prior decisions in light of the existing environment at that particular time (e.g., evolving threat, changing economic conditions).

From initiation in the early 1960s until 2001, the basic PPBS process remained relatively stable. Documentation and submissions of individual phases of Planning, Programming, and Budgeting being developed, and decisions were made sequentially. In 2001, the OSD changed the process to require a combined Programming/Budgeting phase with concurrent preparation and submission of the various Programming and Budgeting documentation and submissions, with corresponding decisions made almost in parallel to ensure coordination.

By a May 22, 2003, document (Management Initiative Decision 913), DepSecDef Paul Wolfowitz made substantive changes to the previous PPBS. Among other changes, PPBS was renamed as the PPBE process. The word "Execution" was added for increased emphasis on the need to better manage execution of the budget authority provided by Congress in response to the DoD portion of the PB. This “execution” was to be more than simply ensuring obligation of the budget authority in a timely manner; it was to include an analysis of the comparison between what DoD said it would do with its appropriations and what it actually accomplished (i.e., outcomes achieved).

Another significant change from PPBS was the decrease in the annual “revisiting” of decisions made in the prior year programming and budgeting cycle (i.e., second year of the previous PB). The approach under the 2003 PPBE was to do a more thorough, but less frequent, analysis and matching of resources against requirements, and to continually evaluate whether individual programs were providing the expected benefits (i.e., greater emphasis was to be given to the evaluation of performance outputs than to budgetary inputs). The intent of this approach was to drive improved upfront resource allocation decisions and combine a review of the effectiveness with which congressional funding was used to accomplish the DoD-assigned missions. In April 2010, there were several major OSD-level decisions that further changed the PPBE process. One, by SecDef Robert Gates, requires “front-end assessments” (FEAs), early in the PPBE cycle, of the multiple capability areas that drive operational, force structure, and investments to better shape Pentagon decisions for the upcoming fiscal year. Another decision put in place by the SecDef was to combine two strategic planning documents into one document, the Defense Planning Guidance (DPG). The other, by DepSecDef William Lynn, returned the PPBE cycle to an annual process rather than the 2-year cycle put into place in May 2003.

Additional details of these changes—as well as others that might be made in this current fluid process—will be covered in the following sections of this adapted and edited excerpt from the 2011 teaching note on PPBE by Siobhan Tack, DAU professor of financial management, and material from ACQuipedia.

Program Structure

Future Years Defense Program (FYDP)

The vitality of the PPBE process is captured in the **Future Years Defense Program (FYDP)**, a computerized database that summarizes forces, resources, and equipment associated with all DoD programs approved by the SecDef. It also summarizes the changes approved from the last official update of the database. The FYDP displays—by fiscal year—total DoD resources and force structure information for the prior year, current year, a single budget year, and the following 4 years (i.e., the "outyears"). In addition, it includes force structure information for an additional 3 years beyond the 4 ***"outyears."*** The FYDP is updated two times during the PPBE cycle:

(1) upon submission of the Components' combined **Program Objective Memorandum/Budget Estimate Submission (POM/BES)** (for calendar year 2010, the suspense date for that submission was July 30, 2010).

(2) and in January of the following year to reflect the DoD portion of the PB that will be submitted to Congress the following month.

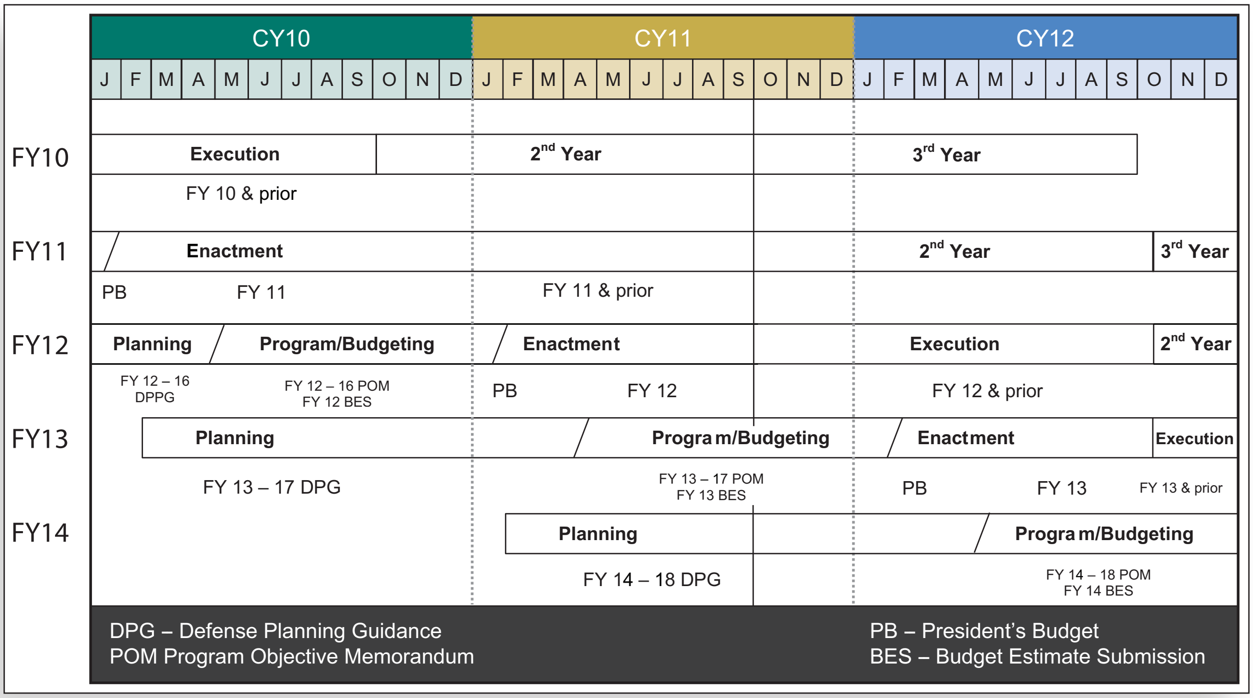
The FYDP is considered an internal DoD working document and is closely held within DoD. Since the FYDP outyear programs reflect internal planning assumptions, FYDP data beyond the budget year are not to be released outside the Executive Branch without permission of the SecDef or Under Secretary of Defense (Comptroller) (USD[C]). However, in response to a 1987 law, DoD is required to provide congressional oversight committees and the Congressional Budget Office, within 120 days of the PB submission, a special publication of the FYDP that includes procurement and RDT&E annexes displaying data for the prior, current, budget, and 4 outyears. An exception to this submission was the FY2010 PB, which provided data for FY2010 only.

Overview of the PPBE Process

Because the PPBE process is calendar-driven (i.e., there is a requirement that by a specified date a specified action must be accomplished, a specified event must occur, or a specified decision must be made), it is appropriate to view those required actions, events, and decisions along a timeline. However, because some DoD appropriations are active (i.e., currently available for new obligations) for several fiscal years rather than for just a single fiscal year, and those required activities, actions, events, and decisions overlap among fiscal years and calendar years, the timeline must be able to accommodate multiple fiscal years as well as those multiple events and activities that occur during those years.

The “Resource Allocation Process—Overlap” chart at Figure 1 shows the relationship between what is happening (i.e., status of actions, events, and decisions) in multiple fiscal years and when those things should occur (i.e., the calendar year). The primary purpose of the chart is to provide a guide to determine when a specific aspect of planning, programming/budgeting, execution, or congressional enactment on the PB is occurring any time during a 3 calendar-year period. There are 3 calendar years across the top and 5 fiscal years along the left side of the chart. Inside the chart are the events, activities, and decisions that occur during each of the 5 fiscal years. This chart is designed to give maximum flexibility for use during the 3 calendar years shown across the top of the figure. There is, however, an important limitation to the use of the overlap chart—that pertaining to the “where” those events, activities, and decisions occur. All actions inside the chart occur at/between/among headquarters of the military departments, defense agencies, OSD, and Congress (i.e., consider these as “Washington” actions). The overlap chart does not necessarily indicate “when” actions occur at the major command or program office level, although there may be some concurrency of actions at those levels and at higher command levels. Program offices normally would provide input for programming and budgeting requests to their respective Service headquarters or defense agency several months before the headquarters/agency submits its programming and budgeting request to Office of the Secretary of Defense (OSD). To determine times of resourcing activities, go to the top calendar months to determine "time now" or a specific month of interest. The fiscal years shown on the left side of Figure 1 represent the fiscal years of the appropriation. The activities conducted at that time for those fiscal years shown are described in the horizontal bars.

Figure 1: Resource Allocation Process—Overlap



Annual Cycle vs. Biennial Cycle

As previously stated, during April 2010 the Secretary and Deputy Secretary of Defense made several decisions that impacted the PPBE process for actions and decisions relative to resource management during calendar year 2010 and that are anticipated to have a similar impact on the follow-on calendar years. Probably the most significant change made to the overall PPBE process, when compared to the process used between 2003 and 2009, is the return to an annual cycle in lieu of a biennial cycle (i.e., conducted every 2 years). The biennial cycle was consistent with the congressional requirement that DoD include a 2-year budget request (e.g., FY08 and FY09) in the President's Budget of an even-numbered fiscal year (e.g., FY08) and to only update the second year of the previous 2-year budget request in the PB of the following year (e.g., FY09). That requirement was contained in the DoD Authorization Act of 1986 (PL 99-134, Section 1405). However, in the DoD Authorization Act of 2008 (PL 110-181, Section 1006), Congress repealed the requirement for a DoD 2-year budget submission. Lack of a legal requirement for DoD to submit a 2-year budget probably was a contributing factor to return to the annual PPBE cycle. The annual cycle also will enable the Components, Office of the Joint Chiefs of Staff (OJCS), and OSD to conduct a more timely analysis of the capability areas that drive operational, force structure, and investment requirements. Budget requests are based on the need to provide resources to satisfy the highest priorities of capabilities needed to accomplish missions, and an annual review of the relative priorities tends to achieve a more effective application of available funds to provide those capabilities.

Annual Cycle

Front-End Assessments

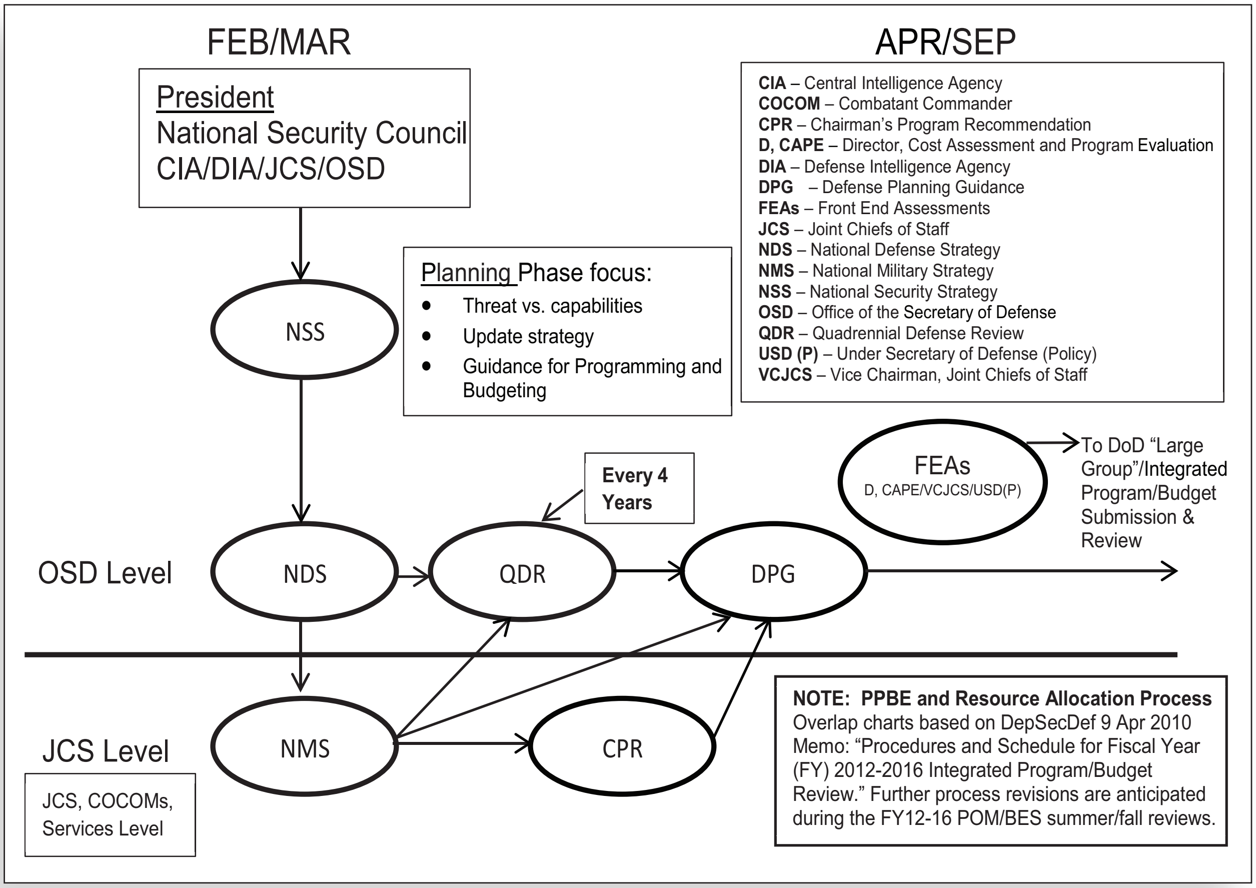
Another significant change to the PPBE process is the institution of a new analytic effort to be done during the summer and fall—that of a "front-end assessment" (FEA) of the multiple capability areas for which resource requirements ultimately will be identified during the programming and budgeting process. The basic concept is that these new FEAs, which are to be conducted earlier in the PPBE process than previous similar analysis with follow-on guidance (i.e., perhaps some assessments will be completed prior to submission of Components' POM/BES), will result in more efficient and effective allocation of resources to satisfy the highest-priority capability areas.

Perhaps because specific details of the new PPBE process are still evolving even while the process is being implemented, OSD has not published and disseminated formal guidance describing details of the process. Notwithstanding the lack of formal guidance, the authors of this teaching note believe it necessary for academic purposes to describe our best understanding of the new PPBE process at this time.

Planning

Planning is the first step in the DoD resource allocation process (shown in ***Figure 2***) and is accomplished by almost parallel actions by the civilian side of OSD (USD Policy) and the military side (led by Joint Chiefs of Staff [JCS] with participation of the Services and COCOMs). Although USD (Policy) is the official lead for the Planning Phase of PPBE, the Chairman of the Joint Chiefs of Staff (CJCS) plays a significant role in the process. This phase begins with issuance of the National Security Strategy (NSS) (which includes input from multiple federal agencies that defines specific national-level strategic outcomes that must be achieved and/or are further refined in the SecDef's National Defense Strategy (NDS) and the CJCS's National Military Strategy (NMS).

Figure 2: PPBE Planning Phase



The first activity in the Planning Phase of PPBE is a review of previous guidance and the most current NSS. This review also examines the evolution in required capabilities and changes in military strategy and policy as documented in the NDS issued by the SecDef. The NDS provides strategic guidance on the priority of defense missions and associated strategic goals. The review also includes the NMS issued by the CJCS. The NMS provides strategic direction on how the Joint Force should align the military ends, ways, means, and risks consistent with the goals established in the NDS. Both the NDS and the NMS should be in compliance with the goals and objectives of the NSS. The Planning Phase also includes a review and analysis of the OSD Quadrennial Defense Review (QDR); the most recent was submitted to Congress in February 2010. The QDR provides the results of a comprehensive examination of potential threats, strategy, force structure, readiness posture, modernization programs, infrastructure, and information operations and intelligence. All of the previously mentioned documents provide strategy-based planning and broad programming advice for the preparation of the Defense Planning Guidance (DPG), which depicts a combined long-term view of the security environment and helps shape the investment blueprint for the 5 POM years,

In implementing a Department of Defense Directive (DoDD), the Capability Portfolio Managers (CPMs) are charged with developing capability portfolio planning guidance and programming, budgeting, and acquisition advice. The overall role of CPMs is to manage assigned portfolios by integrating, coordinating, and synchronizing programs to optimize capability within time and budget constraints.

The JCS-level Joint Requirements Oversight Council (JROC), along with the Joint Staff, assists the CJCS in identifying and assessing the priority of joint requirements, studying alternatives, and ensuring priorities conform to and reflect resource levels projected by the SecDef. Within the Planning Phase, the JROC provides suggested issues and recommendations for the Chairman's program recommendation (CPR), which is intended to influence the DPG. The CPR provides the CJCS's program recommendations that are intended to enhance joint readiness, promote joint doctrine and training, and satisfy warfighting requirements. Overall JCS participation in the Planning Phase is governed by the Joint Strategic Planning System (JSPS), CJCS Instruction (3100.01), and CJCSI 8501.01A, which addresses participation by the CJCS, the COCOMs, and the Joint Staff in the DoD PPBE process.

In general, the Planning Phase identifies the capabilities required to deter and defeat threats and defines for the upcoming Programming Phase national defense policies, objectives, strategy, and guidance for resources and force requirements to meet the capabilities and objectives. The Planning Phase begins about 3 years in advance of the first fiscal year for which budget authority will be requested in the President's Budget. For example, the planning to support the FY12 budget request began in the early part of calendar year 2009. The Planning Phase ends with the issuance of the DPPG, which is prepared by the OSD Director of Cost Assessment and Program Evaluation and released by the SecDef. The DPPG sets specific fiscal controls and directed explicit program actions for each military department and defense agency.

Programming

The purpose of the Programming Phase is to allocate resources to support the roles and missions of the military departments (i.e., Army, Air Force, Navy, and Marines) and defense agencies. During the Programming Phase, previous planning decisions, OSD programming guidance contained in the DPG, and congressional guidance are translated into detailed allocations of time-phased resource requirements, which include forces, personnel, and funds. This is accomplished through systematic review and approval processes that "cost out" force objectives and personnel resources in financial terms for 5 years into the future. This process gives the SecDef and the President an idea of the impact that present-day decisions will have on the future defense posture. The OSD Director of CAPE is responsible for overall coordination of the Programming Phase and is considered the official lead for this phase of PPBE.

Program Development

In the July-August timeframe, each Component (military department and defense agency) submits a combined POM/BES to the SecDef. The POM/BES covers the 5-year FYDP and presents the Component's proposal for a balanced allocation of available resources within specified constraints to satisfy the DPG. Significant force structure and end-strength changes, as well as major system new starts, must be identified. Program imbalances and shortfalls in meeting DPG and warfighter objectives also are to be highlighted.

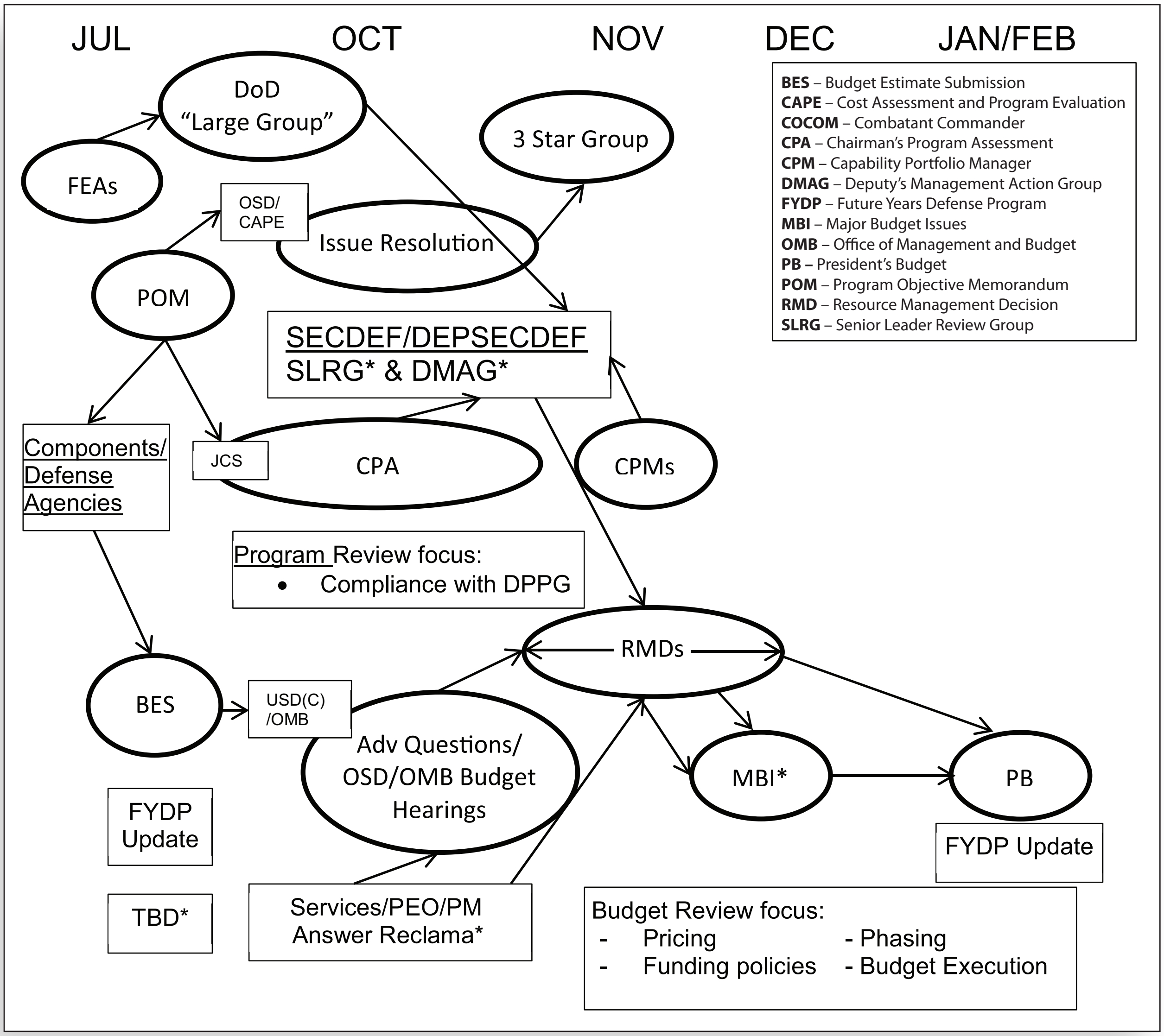
Program Review and Decisions

Following submission of the combined POM/BES (see Figure 3), the Joint Staff, JROC, and CPMs review the POM portion of the military departments', Components', and defense agencies' submissions to assess how they have conformed to the priorities and resource constraints addressed in the DPG, NMS, and the QDR. The results of the Joint Staff and JROC reviews are included in the CPA which is issued during the fall and which may include alternative program recommendations and budget proposals to achieve greater conformity with the stipulated priorities. The CPMs' assessments are submitted to the Deputy's Management Action Group (DMAG) chaired by the DepSecDef. The CPMs may outline alternative investment recommendations to those submitted in the POMs.

Concurrent with the Joint Staff review of the POM portion of the POM/BES, program analysts in the Director of CAPE's office conduct a detailed review of the Services' and defense agencies' POM submissions and make program change recommendations through POM Issue Papers. These documents define specific issues to be reviewed by comparing the proposed program to the objectives and requirements established in the DPG. The Issue Papers present alternatives and evaluate the implications of each alternative, including cost and personnel changes. The Services, Joint Staff, and OSD directorates may comment on the recommendations in the POM Issue Papers, including justification provided in support of the original POM submission.

During the October-November timeframe, the DepSecDef issues to the military departments and defense agencies one or more Resource Management Decisions (RMDs), summarizing the program decisions in the current cycle. These RMDs approve, with the indicated changes, the Service/agency POMs. RMD documents now are issued in lieu of PDMs and Program Budget Decisions (PBDs) (see further discussion that follows).

Figure 3: PPBE—Integrated Program/Budget Review



Budgeting

The USD (Comptroller) is responsible for overall coordination of the Budgeting Phase and is considered the official lead for the Budgeting Phase of PPBE. The Budgeting Phase occurs concurrently with the Programming Phase. After submission of the combined POM/BES (see **Figure 3**), budget analysts in the USD(C) office and budget examiners from the OMB conduct a review of the BES portion of the Components' submission. (Per agreement between OSD and OMB, senior budget examiners from OMB participate in the DoD budget review process at this point to preclude the necessity of OSD submitting the Defense Budget to OMB for a separate review prior to it being integrated into the PB as is required for all other federal agencies.) The Comptroller and OMB emphasis during this review is on proper budget justification and execution. However, the analysts and examiners also consider program alternatives being developed on the programming side. OSD decisions pertaining to program issues (i.e., RMDs issued during the concurrent POM/BES review) also must be incorporated into other OSD decisions being made during the Budgeting Phase. The concurrent review of a combined POM/BES from the various components—rather than sequential reviews of the POM and BES by the different elements at the OSD level—is considered to be more efficient because the same or similar issues addressed in the POM review need not be revisited in the BES review process.

The product of this review and decision process will become the Defense portion of the PB. Continuing a practice that began with the FY1988 budget submission to Congress, DoD then submits an annual budget to Congress.

Budget Process

Prior to submission of the combined POM/BES to OSD, operational organizations and field activities such as program offices begin developing their individual budgets as a prelude to the headquarters' call for budget estimates. This development action may begin as early as midfall prior to submitting their budget estimates to the Service headquarters in early spring. Each Service conducts a budget review. The reviews give the Services an opportunity to internally address budget display/justification problems before submitting the combined POM/BES to OSD in July. The Services generally are trying to put together a balanced funding request that complies with published fiscal constraints. The combined POM/BES also must include adjustments for pay (military and civilian) and for any pricing policies developed between OSD and OMB. The FYDP is updated at the POM/BES submission.

OSD Budget Review

As previously mentioned, budget analysts from USD(C) and budget examiners from OMB normally conduct a joint review of the POM/BES from August to early December. OMB retains the authority to submit separate review decisions, but, in practice, rarely does so. The USD(C) budget analysts may issue advance questions to obtain written responses from the program offices and/or Components. After reviewing these responses, the budget analysts may conduct hearings to review appropriations or specific programs (although this is not a formal requirement). Appropriate Service functional staff and OSD program advocates provide information as necessary during those hearings. During the review, the budget analysts examine the BES from each Service and defense agency to assess conformity with other higher-level guidance.

Four of the areas considered by the USD(C) budget analysts and OMB budget examiners as principal issue areas during the review and "scrub" of the Services' and agencies' budget submissions include: *program pricing, program phasing, funding policies,* and *budget execution.*

- ***Program pricing***—Examines whether the specific program has been properly priced (e.g., that the budget was prepared on the basis of "most likely cost" of the work to be done and that the proper escalation index has been applied to the constant-year budget estimate to determine the then-year funding requirement).

- ***Program phasing***—Examines the compatibility between the approved acquisition strategy and the funding necessary to pay for the requirements shown in that strategy (e.g., have procurement funds been phased properly to coincide with program plans for contract awards?).

- ***Funding policies***—Examines the compliance of the budget request with the proper funding policy for each appropriation category being requested (e.g., RDT&E has been budgeted on an incremental basis; Procurement and MILCON on a full-funding basis; and O&M and MILPERS on an annual basis).

- ***Budget execution***—Examines the efficiency with which the organization has executed (i.e., obligated and expended) currently available funds, and the effect of current year execution on budget year submissions. As an example, has the organization met established goals for obligations and expenditures during the current fiscal year? If not, can those "excess" funds from the current fiscal year be allowed to slip/roll into a future year, allowing for a decrease in the funding requirement in the future year?

Of these four budget review issues, budget execution is the primary focus during this portion of the process. This focus on execution is intended to ensure that the limited funding available for a given fiscal year is used to satisfy as many requirements as possible.

Resource Management Decisions (RMDs)

For the FY2010, FY2011-FY2015 cycles, and the FY2012-FY2016 cycles, Resource Management Decisions (RMDs) signed by the DepSecDef were issued in place of PDMs and PBDs. Per the SecDef's direction, the issues and decisions previously addressed in the POM and BES reviews and documented in two separate documents were combined into a single document with two separate sections addressing programming and budgeting. This approach significantly reduced the number of decision documents. In addition, because of the extensive POM and BES issue deliberations within and between the various senior leadership groups within the DoD (i.e. 3-Star Programmers, Deputy's Management Action Group [DMAG], Senior Leader Review Group [SLRG]) prior to the issuance of an RMD, the SecDef has tried to limit the use of the Major Budget Issue (MBI) process.

Following a thorough review of the POM/BES, questions/answers from the OSD/OMB budget hearings and the review of issues/recommendations coming from the Programming review, a series of RMDs are issued. These RMDs for the FY 2012-2016 FYDP review were broken down into three distinct chapters within the RMD: Budgeting (prepared by USD(C)); Programming (prepared by USD CAPE); and Economics/other. Decisions/changes to the POM/BES, based on these three areas of review are reflected in the RMDs.

In the past, a draft PBD/PDM would be issued to the Services and Components for review and/or to reclama (request through official channels for the issuing authority to reconsider its action). Using the RMD process in the FY2012-2016 review, the Services and Components were given only an opportunity to comment on a selected list of issues. They were not given the opportunity to reclama the actual RMDs. The RMDs were signed by the SecDef and became the final decision documents to the FY2012-2016 PPBE review process.

President’s Budget

The Services revise their budgets to incorporate the decisions from the concurrent program and budget review process (signed RMDs) for inclusion in the PB. After a “top line” meeting between the SecDef, OMB director, and the President, the PB is finalized in early January and submitted through OMB for consolidation with budget requests from all other federal agencies to Congress no later than the first Monday in February. The FYDP also is updated to reflect the PB. These actions end the Budgeting Phase of PPBE and begin the congressional enactment process.

Execution Review

The final activity in the PPBE process is the execution review, which occurs concurrently with the program and budget reviews. The purpose of the program review is to prioritize the programs that best meet military strategy needs; the purpose of the budget review is to decide how much to spend on each of these programs; and the purpose of the execution review is to assess what is received for the money spent (i.e., actual output vs. planned performance). Performance metrics are developed and used to measure program achievements and attainment of performance goals. These metrics will be analyzed to ascertain whether resources have been appropriately allocated.

The Service Players

Each of the Services approaches the PPBE process somewhat differently. In each approach, however, the timely flow of information from the program office to decision makers in the Pentagon throughout all phases of the PPBE process is essential to the success or failure of a program. As discussed below, each Service has a personnel structure established to provide this link between the user, the program office, and the decision makers.

- ***Air Force***—The Program Element Monitor (PEM) is a key player on the Air Staff and within the Office of Assistant Secretary of the Air Force (Acquisition). Each USAF PE is assigned to a PEM who is the conduit between the using commands, Materiel Command, and the Air Staff, while also serving as the spokesperson for the program. His or her duty is to coordinate functional concerns across the Air Staff for all phases of PPBE. A PEM may be responsible for more than one PE.

- ***Navy—***The Requirements Officer (RO) usually is the deputy chief of naval operations (DCNO) resources, requirements and assessments (N-8) staff officer within a mission-oriented resource sponsorship (e.g., subsurface, surface, air, etc.). The RO is responsible for the link between the using commands, systems/developing commands, and OPNAV/SECNAV. He or she prepares and justifies a Navy position on resource allocation within an assigned group of tasks broken out by Joint Mission Area or Support Area. The RO is active in all phases of PPBE.

- ***Army—***The Army PPBE personnel structure is more decentralized than those of the other Services. The Army has a Management Decision Package (MDEP) POC and a Department of the Army systems coordinator (DASC) responsible for many of the PPBE functions described above. Other key players include the user representative or system integrator (SI), the Program Evaluation Group (PEG), and the responsible PEG coordinator who ultimately must approve all MDEPs/programs in the POM. The POC for the assistant secretary of the Army, financial management and comptroller (ASA[FMC]), is a critical player working with the program manager during the budgeting and execution portion of the cycle.

Summary

DoD uses the Planning, Programming, Budgeting, and Execution (PPBE) process to determine priorities and allocate resources. In the Planning Phase, the capabilities required to counter and defeat threats to national security are established, and the forces needed to provide those capabilities are identified. In the Programming Phase, these force requirements are prioritized and resources allocated to best meet the needs within fiscal, manpower, and force structure constraints. In the Budgeting Phase, the Components and OSD scrub all programs to ensure the most efficient use of scarce budget authority. Finally, in the execution review, program output is assessed against planned performance to determine the best return on investment. The programming, budgeting, and execution reviews take place concurrently.

Financial—Appropriations

The PPBE process is how funds are obtained. When Congress appropriates and authorizes the spending of funds, it allocates these funds (for DoD) into categories. There are five main appropriation categories. Accordingly, the LCL must be familiar with these five major appropriation categories, their application and limitations, and their association with each phase of the program's life cycle.

The five categories are:

1. **Research, Development, Test, and Evaluation (RDT&E):** This appropriation category is used for research, development, test, and evaluation efforts. RDT&E funds are used extensively in a program's life cycle when exploring, developing, and testing the design solution. The period of obligation is 2 years, and funds are available for expenditure for 5 years after the obligation period ends.

2. **Procurement:** This appropriation category is used to purchase weapons systems and other investment items. Investment items are typically classified as those items with unit costs in excess of $250,000. Items costing less than $250,000 are classified as expenses. This is from the DoD Financial Management Regulation (FMR), 7000.14-R Volume 2A, Chapter 1, para 010201. The period of obligation is 3 years, and funds are available for expenditure for 5 years after the obligation period ends.
3. **Military Construction (MILCON):** MILCON appropriations are used to purchase, build, or modify real property (e.g., buildings, roads, land) required as part of the support infrastructure. The period of obligation is 5 years, and funds are available for expenditure for 5 years after the obligation period ends.
4. **Military Personnel (MILPER):** These appropriations are used to pay MILPER costs such as basic pay, allowances, special pay, bonuses, and moving costs. The period of obligation is 1 year, and funds are available for expenditure for 5 years after the obligation period ends.
5. **Operations and Maintenance (O&M)**: Includes appropriations used to pay for day-to-day operations not included in the other appropriations, such as fuel, civilian personnel salaries, and end items that do not exceed the current investment/expense threshold of $250,000 system unit cost. O&M funds are what operational units use to fund their training, exercise, and combat operations. The period of obligation is 1 year, and funds are available for expenditure for 5 years after the obligation period ends.

Integrated Product Support Elements

Product support management is the development and implementation of product support strategies to ensure supportability is considered throughout the system life cycle through the optimization of the key performance outcomes of reliability, availability, maintainability, and reduction of total ownership costs. The scope of product support management planning and execution includes the enterprise level integration of all 12 integrated product support elements throughout the life cycle commensurate with the roles and responsibilities of the Product Support Manager position created under Public Law 111-84, Section 805.

(See Product Support Management activities by phase on pp. 115-120 of the *Integrated Product Support* (IPS) *Element Guidebook,* December 2011, found on DAU Acquisition Community Connection (ACC.): https://accc.dau.mil/ips-guidebook.)

Design interface is the integration of the quantitative design characteristics of systems engineering (reliability, maintainability, etc.) with the functional Integrated Product Support Elements (i.e., Integrated Product Support Elements). Design interface reflects the driving relationship of system design parameters to product support resource requirements. These design parameters are expressed in operational terms rather than as inherent values and specifically relate to system requirements. Thus, product support requirements are derived to ensure the system meets its availability goals and design costs and support costs of the system are effectively balanced.

The basic items that need to be considered as part of design interface include:

- Reliability
- Maintainability
- Supportability
- IPS Elements
- Affordability
- Configuration Management
- Safety Requirements
- Environmental and HAZMAT Requirements
- Human Systems Integration
- Calibration
- Anti-Tamper
- Habitability
- Disposal
- Legal Requirements

(See Design Interface activities by phase on pp. 163-168 of the *IPS Element Guidebook.)*

Sustaining Engineering spans those technical tasks (engineering and logistics investigations and analyses) to ensure continued operation and maintenance of a system with managed (i.e., known) risk. This includes:

- Collection and triage of all service use and maintenance data
- Analysis of safety hazards, failure causes and effects, reliability and maintainability trends, and operational usage profiles changes
- Root cause analysis of in-service problems (including operational hazards, deficiency reports, parts obsolescence, corrosion effects, and reliability degradation)
- The development of required design changes to resolve operational issues
- Other activities necessary to ensure cost-effective support to achieve peacetime and wartime readiness and performance requirements over a system's life cycle

Technical surveillance of critical safety items, approved sources for these items, and the oversight of the design configuration baselines (basic design engineering responsibility for the overall configuration including design packages, maintenance procedures, and usage profiles) for the fielded system to ensure continued certification compliance also are part of the sustaining engineering effort. Periodic technical review of the in-service system performance against baseline requirements, analysis of trends, and development of management options and resource requirements for resolution of operational issues should be part of the sustaining effort.

*(*See Sustaining Engineering activities by phase on pp. 201-204 of the *IPS Element Guidebook.)*

Supply support consists of the management actions, procedures and techniques necessary to acquire, catalog, receive, store, transfer, issue, and dispose of spares, repair parts, and supplies. Supply support includes provisioning for initial support as well as acquiring, distributing, and replenishing inventories as reflected in the supply chain management strategy. Proper supply support management results in having all the right spares, repair parts, and all classes of supplies available in the right quantities, at the right place, at the right time, at the right price.

*(*See Supply Support activities by phase on pp. 250-253 of the *IPS Element Guidebook.)*

Maintenance Planning and Management establishes maintenance concepts and requirements for the life of the system for both hardware and software.

It includes, but is not limited to:

- Levels of repair
- Repair times
- Testability requirements
- Support equipment needs
- Training and Training aids devices simulators and simulations (TADSS)
- Manpower skills
- Facilities
- Inter-Service, organic, and contractor mix of repair responsibility
- Deployment planning/site activation
- Development of preventive maintenance programs using reliability centered maintenance
- Condition Based Maintenance Plus (CBM+)
- Diagnostics/prognostics and health management
- Sustainment
- PBL planning
- Post-production software support

Maintenance planning and management is the process of developing, implementing, and managing the maintenance concept, requirements and procedures for a system along with the personnel who will perform the required maintenance tasks, and where they will be accomplished. It includes the identification of all the resources and funding required to develop and implement the maintenance and modernization plan.

*(*See Maintenance Planning and Management activities by phase on pp. 282-285 of the *IPS Element Guidebook.)*

Packaging, Handling, Storage, and Transportation (PHS&T) is the combination of resources, processes, procedures, design, considerations, and methods to ensure that all system, equipment, and support items are preserved, packaged, handled, and transported properly, including environmental considerations, equipment preservation for short- and long-term storage, and transportability. Some items require special, environmentally controlled, shock-isolated containers for transport to and from repair and storage facilities via all modes of transportation (land, rail, air, and sea).

PHS&T focuses on the unique requirements involved with packaging, handling, storing, and transporting not only the major end items of the weapon system but also spare parts, other classes of supply, infrastructure items, and even personnel. The requirements and constraints a military environment imposes on these activities can significantly impact availability, reliability, and life cycle costs of the weapon system. Care must be taken to ensure PHS&T objectives are applied to the entire system and not just the spare and repair parts. Unfortunately, this constrained application happens quite often. Additionally, PHS&T items may require their own life cycle support, such as maintenance of reusable containers or special storage facilities similar to those required for explosives.

PHS&T is defined by its functional areas:

- **Packaging:** Provides for product security, transportability, storability, with the added utility of serving as a medium of communication from the producer to the user. The nature of an item determines the type and extent of protection needed to prevent its deterioration. Shipping and handling, as well as the length of time and type of storage considerations, dictate materials selected for preservation and packing (P&P).

- **Handling**: involves the moving of items from one place to another within a limited range (i.e., normally confined to a single area, such as between warehouses, storage areas, or operational locations) or movement from storage to the mode of transportation.

- **Storage:** infers the short- or long-term storing of items. Storage can be accomplished in either temporary or permanent facilities.

- **Transportation:** The movement of equipment and supplies using standard modes of transportation for shipment by land, air, and sea. Modes of transportation include cargo, vehicle, rail, ship, and aircraft.

(See PHS&T activities by phase on pp. 319-321 of the *IPS Element Guidebook.)*

Technical Data are recorded information of scientific or technical nature, regardless of form or character (such as equipment technical manuals and engineering drawings), engineering data, specifications, standards, and Data Item Descriptions (DIDs). Data rights, data delivery, as well as use of any source-controlled data as part of this element are included in technical data as are "as maintained" bills of material and system configuration identified by individual configuration item. Technical data do not include computer software or financial, administrative, cost or pricing, or management data, or other information incidental to contract administration." See 10 U.S.C. 2302(4).

Technical manuals (TMs), including Interactive Electronic Technical Manuals (IETMs), and engineering drawings are the most expensive and probably the most important data acquisitions made in support of a system. TMs and IETMs provide the instructions for operation and maintenance of a system. IETMs also provide integrated training and diagnostic fault isolation procedures.

For ACAT I and II programs, a Technical Data Rights Strategy is required prior to each milestone review as part of the Acquisition Strategy. Technical data acquisition, management, and rights are defined in the Technical Data Rights Strategy. For additional guidance regarding the Technical Data Rights Strategy, refer to the *Defense Acquisition Guidebook,* Sections 2.2.14 and 5.1.6.4.

*(*See Technical Data activities by phase on pp. 367-370 of the *IPS Element Guidebook.)*

Support Equipment consists of all equipment (mobile or fixed) required to support the operation and maintenance of a system. It includes but is not limited to associated multiuse end items, ground handling and maintenance equipment, tools metrology and calibration equipment, test equipment, and automatic test equipment. It also includes the acquisition of logistics support for the support equipment itself. During the acquisition of systems, program managers are expected to decrease the proliferation of support equipment into the inventory by minimizing the development of new support equipment and giving more attention to the use of existing government or commercial equipment.

*(*See Support Equipment activities by phase on pp. 399-401 of the *IPS Element Guidebook.)*

Training and Training Support consists of the policy, processes, procedures, techniques, training aids devices simulators and simulations (TADSS), and planning and provisioning for the training base—including equipment used to train civilian and military personnel to acquire, operate, maintain, and support a system. This includes new equipment training (NET), institutional, sustainment training, and displaced equipment training (DET) for the individual, crew, unit, collective, and maintenance through initial, formal, informal, on-the-job training (OJT), and sustainment proficiency training. Significant efforts are focused on NET, which, in conjunction with the overall training strategy, shall be validated during system evaluation and test at the individual, crew, and unit level.

Training is the learning process by which personnel individually or collectively acquire or enhance predetermined job-relevant knowledge, skills, and abilities by developing their cognitive, physical, sensory, and team dynamic abilities. The "training/instructional system" integrates training concepts and strategies and elements of logistics support to satisfy personnel performance levels required to operate, maintain, and support the systems. It includes the "tools" used to provide learning experiences such as computer-based interactive courseware, simulators, and actual equipment (including embedded training capabilities on actual equipment), job performance aids, and Interactive Electronic Technical Manuals. It is critical that, to ensure alignment between system design and training program, any and all changes must be evaluated as to the impact on the training program. The training products themselves may require separate configuration management and supportability.

The Product Support Manager needs to understand the requirements for training related to the civilian and military workforce for weapon systems acquisition and the training required for civilians and military to lead, operate, and sustain the weapon system being fielded.

Training performed by DoD can be viewed as focused according to specific outcomes:

- Institutional training for the military and civilian workforce
- Weapon system acquisition-related training developed and implemented to specifically support the fielding of new systems or major modifications of systems
- Operational and field training primarily as part of individual, unit, and organizational training typically conducted at home station, during major training events, and while operationally deployed
- Self-development training where individuals seek additional knowledge growth that complements what has been learned in the classroom and on the job

(See Training and Training Support activities by phase on pp. 427-430 of the *IPS Element Guidebook.)*

Manpower and Personnel involve the identification and acquisition of personnel (military and civilian) with the skills and grades required to operate, maintain, and support systems over their lifetimes. Early identification is essential. If the needed manpower is an additive requirement to the existing manpower levels of an organization, a formalized process of identification and justification must be made to higher authority.

The terms "manpower" and "personnel" are not interchangeable.

"Manpower" represents the number of personnel or positions required to perform a specific task. This task can be as simple as performing a routine administrative function, or as complex as operating a large repair depot. Manpower analysts determine the number of people required, authorized, and available to operate, maintain, support, and provide training for the system. Manpower requirements are based on the range of operations during peacetime, low-intensity conflict, and wartime. Requirements should consider continuous, sustained operations and required surge capability.

"Personnel," on the other hand, indicates those human aptitudes (i.e., cognitive, physical, and sensory capabilities), knowledge, skills, abilities, and experience levels needed to properly perform job tasks. Personnel factors are used to develop the military occupational series of system operators, maintainers, trainers, and support personnel. Personnel officials contribute to the defense acquisition process by ensuring that the program manager pursues engineering designs that minimize personnel requirements and keep the human aptitudes necessary for operation and maintenance of the equipment at levels consistent with what will be available in the user population at the time the system is fielded. More information is found at the Defense Acquisition University's Community of Practice website at ***https://acc.dau.mil/CommunityBrowser.aspx?id=141979 .***

*(*See Manpower and Personnel activities by phase on pp. 458-462 of the *IPS Element Guidebook.)*

Facilities and Infrastructure consist of the permanent and semipermanent real property assets required to support a system, including studies to define types of facilities or facility improvements, location, space needs, environmental and security requirements, and equipment. It includes facilities for training, equipment storage, maintenance, supply storage, ammunition storage, and so forth.

*(*See Facilities and Infrastructure activities by phase on pp. 492-494 of the *IPS Element Guidebook.)*

Computer Resources encompass the facilities, hardware, software, documentation, manpower, and personnel needed to operate and support mission-critical computer hardware/software systems. As the primary end item, support equipment, and training devices increase in complexity, more and more software is being used. The expense associated with the design and maintenance of software programs is so high that one cannot afford not to manage this process effectively. It is standard practice to establish a computer resource working group to accomplish the necessary planning and management of computer resources.

Computer programs and software are often part of the technical data that define the current and future configuration baseline of the system necessary to develop safe and effective procedures for operation and maintenance of the system. Software technical data come in many forms, including, but not limited to, specifications, flow/logic diagrams, Computer Software Configuration Item (CSCI) definitions, test descriptions, operating environments, user/maintainer manuals, and computer code.

Computer Resources constitute the information technology resources and infrastructure required to operate and support mission-critical systems, including manpower, personnel, hardware, software, and documentation such as licenses and services.

*(*See Computer Resources activities by phase on pp. 536-539 of the *IPS Element Guidebook.)*

System Design

Integrated Logistics Support (ILS) is a technique introduced by the U.S. Army to ensure that supportability is considered during weapon system design and development.

The aim of ILS is to address three aspects of supportability during the acquisition of the equipment:

1. **Influence on Design.** An iterative process during the design of the system to ensure that reliability, maintainability, and supportability aspects are considered. This is to ensure the system designer understands the impact of reliability on maintenance actions, the impact of maintainability on maintenance times, and the impact of supportability on the quantity and cost of logistics support.
2. **Design of the Support Solution.** Ensuring that the support solution considers and integrates the ILS elements based on the system design. This is discussed fully later.
3. **Develop and Implement the Product Support Package.** Product support is defined as a package of logistics support functions necessary to maintain the readiness and operational capability of a system or subsystem. The package of logistics support functions can be performed by public or private entities.

Readings

"The Product Support Triad" by Terry Johnson and Dave Floyd, *Defense AT&L* magazine, March–April 2012.

"Leveraging Better Buying Power to Deliver Better Product Support Outcomes" by John Medlin and Jeff Frankston, *Defense AT&L* magazine, March–April 2012.

The Product Support Triad: A Critical Convergence

Terry Johnson ■ Dave Floyd

In the "bad old days" of the Cold War, the United States relied on a strategic deterrence "triad:" long-range bombers, land-based intercontinental ballistic missiles (ICBMs), and mobile nuclear submarine-based ballistic missiles. The combination of these deterrents ensured that a viable strategic deterrence was always maintained.

Similarly, effective product support relies on a triad of focused (and carefully chosen) sustainment outcome metrics, effective interaction among the integrated product support (IPS) elements, and appropriately comprehensive governance.

Over the past several years, statute and DoD policy changes have significantly reinforced product support activities and procedures that, while always acknowledged as best practices, have often fallen victim to budget constraints and real-world events. The enhancements facilitated by the 2009 Weapon Systems Acquisition Reform Act (WSARA), OSD policy memoranda, the *Weapon System Acquisition Reform Product Support Assessment*, and

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implementing DoD and Service guidance are not radical; the cumulative effect has been to significantly strengthen the role of life cycle logisticians in weapon systems acquisition and to strongly re-emphasize the need to design for support, design the support, and support the design. In other words, deliver affordable readiness to the warfighter—and "affordable" in this case applies not only to the acquisition of the weapon system itself, but to its sustainment "tail." How does the triad enable these best practices?

Why Are Sustainment Outcome Metrics So Important?

Most acquisition professionals are aware that sustainment outcome metrics are focused on warfighter requirements, principally the availability components as well as materiel reliability, mean down time, and ownership cost. The sustainment key performance parameter (KPP) and key system attributes (KSAs) form the basis for development of performance-based life cycle product support metrics.

It is an article of faith in the life cycle logistics community that emphasis on reliability early in the life cycle will pay substantial supportability (and availability) dividends once a system is operational. Of particular note is the R*eliability, Availability, Maintainability–Cost* (RAM–C) *Rationale Report Manual*. The purpose of this manual is to assist combat developers, program managers, engineers, and life cycle logisticians in designing RAM into systems early in a program affordably, helping reduce overall life cycle costs.

Whether purely organic, purely commercial, or (most likely) a combination of public and private product support arrangements, DoD's clear preference for performance-based product support, articulated in DoD Directive 5000.01 and DoD Instruction 5000.02, dictates a careful selection of life cycle sustainment outcome metrics upon which these arrangements can be based. Great care must be exercised in determining these metrics; they must reflect and support the warfighter's requirements, particularly those contributing to operational availability, while bearing in mind the axiom, "Be careful what you ask for; you may get it."

Why Are integrated product support (IPS) Elements So Important?

The 12 recently established IPS elements, outlined in the April 2011 DoD *Product Support Manager Guidebook* (https://acc.dau.mil/psm-guidebook), serve as a powerful enhancement and update to the traditional ten Integrated Logistics Support (ILS) elements. Why was this done? The two additional elements, product support management and sustaining engineering, reflect the PSM and life cycle logistician's enhanced enterprise roles and responsibilities that transcend the traditional logistics domain.

The PSM, a key leadership position established by Congress in Public Law 111-84, Section 805, needs to be able to interface effectively with senior leaders from other functional domains including program management, contract management, business and financial management, and systems engineering, in order to develop and implement a viable product support strategy. The IPS elements not only address this need by identifying and defining the associated activities of the PSM, but more importantly convey how these activities are to be accomplished. Furthermore, the product support management element in particular provides the framework for the integration of all the other 11 IPS elements so that the product support solution that is delivered to the warfighter is fully integrated and meets the warfighter's needs in terms of readiness, reliability, and affordability.

Sustaining engineering, another of the 12 IPS elements, reflects the full life cycle focus of the PSM and the kinds of design interface activities, including reliability (the ability of a system and its parts to perform its mission without failure under a prescribed set of circumstances), availability (the degree to which an item is in an operable state and can be committed at the start of a mission at a random point in time), maintainability (the ability of an item to be retained in, or restored to, a specified condition), supportability (includes design, technical support data, and maintenance procedures to facilitate detection, isolation and timely repair or replacement of system anomalies), and affordability (the degree to which the life-cycle cost of an acquisition program is in consonance with the long-range investment and force structure plans),

Sustainment Metrics Definitions

Availability KPP: Mandatory for ACAT I; sponsor decision for ACAT II/III. Two components:

- **Materiel Availability:** Percentage of the total inventory of a system operationally capable of performing an assigned mission at a given time
(Number of Operational End Items/Total Population)
- **Operational Availability:** Percentage of time a system or group of systems within a unit are operationally capable of performing an assigned mission
(Uptime/(Uptime + Downtime))

Mandatory KSAs:

- **Materiel Reliability KSA:** Probability that system will perform without failure over a specified interval. MTBF = (Total Operating Hours/Total # of Failures)
- **Ownership Cost KSA:** Based on Cost Analysis Improvement Group (CAIG) elements: unit operations, energy/POL, maintenance, sustaining support, continuing system improvements, regardless of funding source (O&S Costs Associated w/ Materiel Readiness)

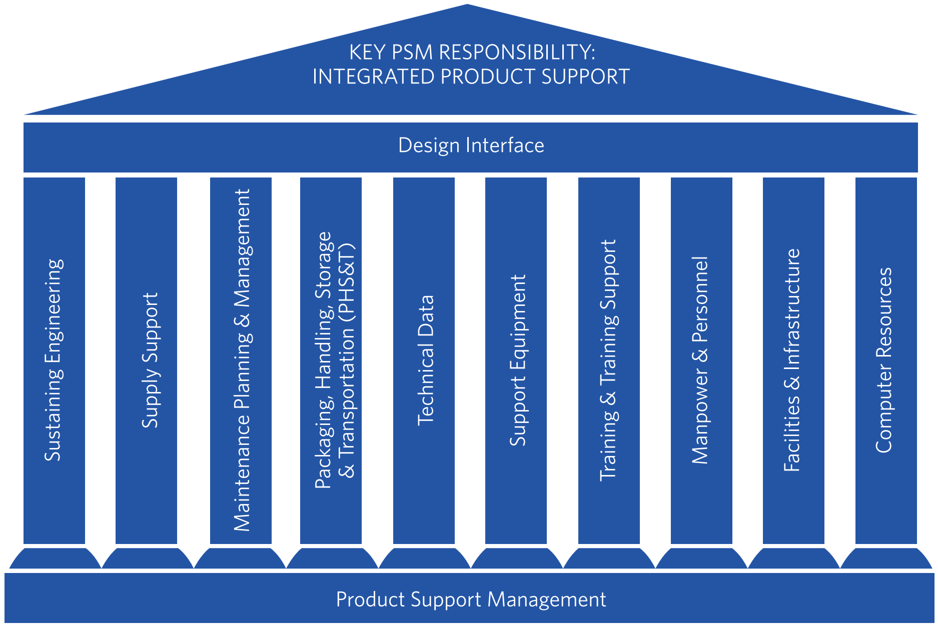
Plus a fourth Sustainment Outcome Metric:
Mean Down Time

- A measure of average Total Downtime required to restore an asset to its full operational capabilities. MDT = (Total Down Time for All Failures/Total Number of Failures) which carry over into the operations and support (O&S) phase of the life cycle. Other modifications to the traditional 10 ILS elements include:

- Maintenance planning transitions to maintenance planning and management, to incorporate maintenance management and execution activities along with the maintenance planning activities
- Training and training equipment becomes training and training support, emphasizing the life cycle focus of the training strategy and implementation
- Facilities becomes facilities and infrastructure, highlighting the fact that facilities are more than simply "brick and mortar" buildings
- Computer resources support changes into computer resources, bringing the computer resources support ILS element up to date by providing more focus on the information technology aspects of computer resources.

To facilitate implementation, execution, and understanding of these 12 elements, the *IPS Element Guidebook*, fielded by DAU in November 2011, provides detailed information about each of the 12 elements and complements Appendix A of the *PSM Guidebook* by providing definitions for each IPS element and sub-element. It also identifies key activities and products for each IPS element and provides a much-needed "how to" for these activities throughout the life cycle. The guidebook is an invaluable reference in helping the program logistician answer the "what, how, and when" product support planning and execution questions.

Figure 1. IPS Element 'Pillars'



Key Product Support Governance References

DoD Directive 5000.01
https://acc.dau.mil/CommunityBrowser.aspx?id=314789

DoD Instruction 5000.02
https://acc.dau.mil/CommunityBrowser.aspx?id=332529

Defense Acquisition Guidebook, Chapter 5
https://dag.dau.mil/

Product Support Manager Guidebook
https://acc.dau.mil/psm-guidebook

Business Case Analysis (BCA) Guidebook

Reliability, Availability, Maintainability, and Cost Rational Report Manual
https://acc.dau.mil/CommunityBrowser.aspx?id=298606

Integrated Product Support Element Guidebook
(link to be provided—not published as of 11-15-11)

Why Is the Added Emphasis on Governance So Important?

What exactly is governance? For our purposes here, "governance" relates to "consistent management, cohesive policies, guidance, processes and decision-rights for a given area of responsibility." Simply put, the increased emphasis on life cycle management governance is intended to both improve product support and enhance the tool kit available to program product support personnel. As a life cycle logistician in weapon system acquisition, what am I supposed to be doing—and when? The recent emphasis in public law, OSD policy, and specific areas addressed by the new guidebooks all strive to answer not only the "what?" but also the "how?" Outcomes are critical, but we also need to make sure our workforce knows routes as well as destinations.

The recent emphasis on product support and life cycle management governance can be categorized as both strategic and tactical. The strategic governance addresses—among other topics—the increased emphasis on affordability in the acquisition of weapon systems, initiatives grouped under the broad rubric of better buying power. Strategic governance also continues to emphasize and clarify the roles and responsibilities of key program personnel (e.g., the product support manager). As another example, the sustainment "quad chart" (Figure 2) mandated by DoD policy for major defense acquisition programs (MDAPs), focuses on those areas key to effective product support: the sustainment approach and related issues, schedule, metrics, and cost. While required only for MDAPs, the focus areas actually apply equally to all programs; the chart provides an excellent "snapshot." Is any of this really new? Generally not; most of the recently issued product support governance policy seeks to reinforce and reemphasize practices and procedures that experience has taught will lead to effective and affordable supportability. The "quad chart" has become a critical component of major program reviews as well as milestone decision reviews; the emphasis on planning for affordable sustainment has migrated from "the last bullet on the last chart in 'backup'" to the forefront of acquisition decisionmaking.

The governance tactical focus is on "news you can use." *The PSM Guidebook, the BCA Guidebook, the Logistics Assessment Guidebook*, and others still in development (all of which can be accessed at https://acc.dau.mil/productsupport) each concentrate on the "how to and when" aspects of product support planning and implementation. See sidebar for a list of some of these important tools. Again, most of the content of these documents is not radically new—but for the first time, the life cycle logistician and program leadership have comprehensive, detailed resources that will lead to supportability success.

Figure 2. Sample Quad Chart

SAMPLE PROGRAM: "ABC"

Date:

Product Support Strategy

Sustainment Approach
- Current (initial CLS covering total system)
- Future (sub-system based PBL contracts)

Issues
- Shortfall in O&M funding in FYDP
- Reliability and availability estimates are below goals
- LCSP requires update before DAB

Resolution
- POM request for O&M restoration submitted
- Reliability improvement plan with clear RAM goals up for final signature
- LCSP in draft

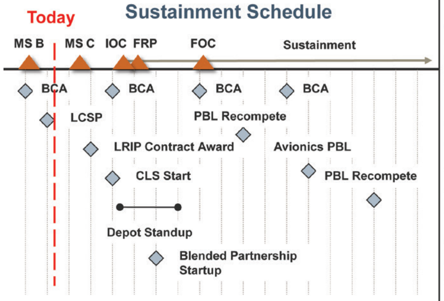
Metrics Data

Metric	Antecedent Actual	Original Goal	Current Goal	Current Estimate/ Actual
Materiel Availability	76%	80%	77%	71%
Materiel Reliability	37 hrs	50 hrs	50.5 hrs	48 hrs
Ownership Cost	245.6B	385.5B	395.1B	395.1B
Mean Down Time	12 hrs	20 hrs	18 hrs	15 hrs

* Test or fielding event data derived from _______

Notes:

Sustainment Schedule



O&S Data

Cost Element	Antecedent Cost	ABC Original Baseline	ABC Current Cost
1.0 Unit-Level Manpower	3.952	5.144	5.750
2.0 Unit Operations	6.052	6.851	6.852
3.0 Maintenance	0.739	0.605	0.688
4.0 Sustaining Support	2.298	2.401	2.401
5.0 Continuing System Improvements	0.129	0.025	0.035
6.0 Indirect Support	1.846	1.925	1.956
Total	**15.046**	**16.951**	**17.682**

Cost based on average annual cost per squadron

Total O&S Costs	Antecedent	ABC
Base Year $M	102,995.2	184,011.9
Then Year $M	245,665.3	395,147.2

Three-Legged Stools Are the Most Stable

The renewed—and increased—emphasis on metrics, integrated product support, and product support governance is important to the program logistician, certainly. But this emphasis also benefits the customer, the program manager, the system engineer—basically all stakeholders—because it focuses activities and resources on a common goal and contributes directly to integrating program efforts toward a common goal.

These three key areas—sustainment metrics, the integrated product support elements, and governance—meld together to provide program managers, product support managers, system engineers, and life cycle logisticians a detailed structure and body of process knowledge leading to our ultimate goal: delivering to the warfighter weapon systems that meet their validated requirements, and which the taxpayers can afford.

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Leveraging Better Buying Power to Deliver Better Product Support Outcomes

John Medlin ■ Jeff Frankston

How often have you heard the expression that systems are "thrown over the fence" from acquisition to sustainment? Or that systems which transition from acquisition to sustainment often didn't adequately plan for and fund sustainment? As a result of this real or perceived scenario, the under secretary of Defense for acquisition, technology and logistics (USD(AT&L)) has been elevating the prominence of sustainment planning in requirements and acquisition, and instantiating it in policy documentation.

The import of sustainment planning and implementation is also reflected in the Sept. 14, 2010 USD(AT&L) memorandum, *Better Buying Power: Guidance for Obtaining Greater Efficiency and Productivity in Defense Spending*, which requires programs to establish an affordability target for a system's life cycle cost at Milestone A. It specifically states that in addition to a program's acquisition cost, the affordability calculation must include the system's operations and support (O&S) costs.

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The Nov. 3, 2010, USD(AT&L) memo, *Implementation Directive for Better Buying Power—Obtaining Greater Efficiency and Productivity in Defense Spending*, provides implementation detail that is more tactical and establishes the O&S cost baseline to be the "… average annual operating and support cost per unit." This requires a disciplined process to assess the new system's O&S cost for use in the "…quantitative analysis of the program's portfolio or mission area across the life cycle of all products in the portfolio or mission area."

The memo goes on to mandate that for new programs, specific adjustments to portfolio or mission areas will be identified to absorb the new program. This requires strong and detailed communication between the three communities of the DoD Decision Support System—the Joint Capabilities Integration and Requirements System (requirements), the Defense Acquisition System, and the Planning, Programming, Budgeting and Execution System.

For Milestone B, the memo changes the affordability target to an affordability requirement and further illuminates the O&S element; it also requires programs to document the affordability requirement in the Acquisition Decision Memorandum (ADM) and ensures linkage to the O&S cost element of the Acquisition Program Baseline (APB). While some may perceive this as a new requirement, it is not; rather, it builds on existing statutory language in Title X, Section 2435, baseline description, which specifically cites supportability as a parameter to be included in the baseline (e.g., acquisition program baseline). This has also long been reflected in the selected acquisition reports (SAR) within the report's O&S cost section.

Another cited element in the Better Buying Power memos that specifically affects sustainment is open systems architecture and the related acquisition of technical data rights. This is an integral element of the engineering tradeoff analysis that will be completed and presented at a program's Milestone B. A major purpose for the two elements is to ensure the government has the right information to compete future contracts (i.e., design documentation, interfaces, tools and information that can be shared with others). The data rights included in this element are not new, though arguably they may represent a poorly understood area, especially with respect to the sustainment aspects of technical data. Title X, Section 2320, Rights in Technical Data, has been in force for many years and instantiated in various Defense Federal Acquisition Regulation Supplement sections, and is dependent on multiple factors:

- Rights granted to the government depend on the nature of the data (form, fit, function, operations, maintenance, installation, and training)
- The source of funding for the item, process, or computer software (100 percent government, 100 percent private, mixed)
- Whether the government secured data rights through other agreements (cooperative research and development agreements)

Although planning and implementation of technical data rights is not the primary purpose of this article, data rights decisions made during acquisition do have far-reaching implications over the system's life cycle including sustainment activities. Specifically, the Better Buying Power memos require a business case analysis (BCA) that includes "…acquiring technical data rights to ensure sustained consideration of competition in the acquisition of weapon systems." By extension, the information in the initial BCA for technical data rights should inform the sustainment BCA completed to support Milestone B; the sustainment BCA was mandated in the same legislation and subsequent directive type memo that established the product support manager. As programs progress through the acquisition cycle, there exists a deliberate and effective review process that in the year since the BBP memos release, has now grown to include most or all of the major tenets of BBP. This includes the sustainment aspects of BBP which linked directly with ongoing sustainment governance and visibility improvements in the acquisition process.

The integrated process team (IPT) system has been one of the primary beneficiaries of BBP changes. From the lowest-level working IPT (WIPT), through the more senior Integrating IPT (IIPT) and overarching IPT (OIPT), up to the Defense Acquisition Board (DAB), BBP initiatives are now mandatory reporting elements for each program. All programs report on will cost/should cost implementation initiatives. Will cost/should cost is an analytical process that seeks to preclude cost overruns from exceeding the independent cost estimate (will cost) at which the program is funded, by conducting disciplined analysis of all government and contractor cost elements to arrive at a should-cost figure. Portfolio reviews for all systems within a given commodity group are mandatory briefing elements. Presentations on the development and status of affordability targets are now required.

While the primary focus of these particular BBP directives has been in the acquisition realm, there are a number of examples of programs applying them to sustainment, which is becoming the norm for programs coming before IPT or DAB meetings. The OHIO Class ballistic missile submarine replacement program is a prime example. The OHIO Replacement (OR) went through its Milestone A decision in late 2010, following a lengthy analysis of alternatives review. In the procession of meetings leading up to the DAB, it was evident that both the acquisition and sustainment cost projections were becoming unaffordable. The OR program became the first major program to have the BBP initiatives applied to it.

At the OR DAB, the USD(AT&L) cited the Navy's unit costs and O&S costs as too high and unaffordable. Using the new affordability target mandate for Milestone A, USD(AT&L) and the Navy worked to shed additive capabilities beyond the minimum requirements for national security to lower the unit cost. Additionally, the Navy's assumptions on their average annual O&S cost per boat were declared unaffordable, and the Navy committed itself to a target that will match or improve upon current OHIO class O&S costs. Similarly, the littoral combat ship (LCS) program had a hard requirement for annual support costs set at their Milestone B decision in early 2011. These actions were merely the first examples of the enhanced amount of attention that sustainment and sustainment affordability now receive at programmatic reviews.

Another review forum that has seen increased sustainment focus and attention is the Defense Acquisition Executive Summary (DAES) meeting. All major defense acquisition programs (MDAPs) submit quarterly DAES reports, which are also assessed by OSD, and then a review is held monthly on select programs. The DAES process is used by DoD to monitor and assess the health of programs and identify and resolve risks before they become issues. Use of the DAES meeting as a forum for programmatic decision-making has been growing over the last 2 years to the point where DAES meetings have become equal to OIPTs in the amount of detail covered. Sustainment is not lacking for emphasis in this expansion.

Sustainment issues are primarily addressed on the Sustainment Quad Chart (Figure 1). The quad chart, which covers sustainment strategy, schedule, sustainment metrics performance and O&S costs, was mandated for all programmatic reviews in April 2010 by the USD(AT&L). It proved extremely popular in OSD management of sustainment issues, and its use was mandated for all DAES reviews. At the DAES meetings, sustainment performance and overall affordability are considered on par with all other programmatic decision making. Affordability targets/requirements are tracked directly in the O&S cost portion of the quad chart, tying directly into the other mandatory BBP slides in the DAES brief. The product support manager (PSM) needs to be an activist in ensuring the chart reflects the current sustainment picture. It is an opportunity to highlight issues that require resolution or show off where a program has excelled in sustainment.

The acquisition phase has been the primary focus of the other initiatives of BBP. From mandatory reviews of should cost/will cost to portfolio views of similar systems, acquisition costs currently receive most of the attention. This should not be the case. The PSM should be actively seeking to find sustainment savings in a should-cost environment. When the CAPE gives their O&S cost projection in the independent cost estimate (ICE), the PSM should treat this as a challenge to provide the required sustainability at a better cost relative to the ICE. The majority of expenditure for a program will be O&S dollars, so a true affordability focus cannot overlook sustainment costs.

Similarly, a true portfolio view of costs would look at O&S expenditures, not just the acquisition budget. In a period of flat or declining budgets, fielding a new system that costs more than what it replaces is probably not affordable. An excellent example of this type of concern is the Army's cost control efforts on the Ground Combat Vehicle ahead of the Milestone A decision in mid-2011. Emphasis on affordability across the life cycle led the Army to review and agree to an annual support cost per vehicle in consumables and repairables, compared to both what it was replacing, and the total expenditures in their heavy brigade portfolio.

Understanding the overall affordability now leads to better decision-making and a more supportable and affordable capability for the future warfighter. The Sustainment Quad Chart is the PSM's primary tool for highlighting the sustainment elements of a program, but a PSM's role does not end there. Capitalizing on the initiatives in the BBP memos, the PSM needs to understand how they affect their engagement in the program and its review process. While the largest potential savings are in the sustainment phase, an activist PSM should develop and present their program manager alternatives and analyses on the BBP tenets during the acquisition cycle. The current fiscal and political climate is ripe for aggressive promotion of affordability initiatives, with sustainment having an equal seat at the table for the first time.

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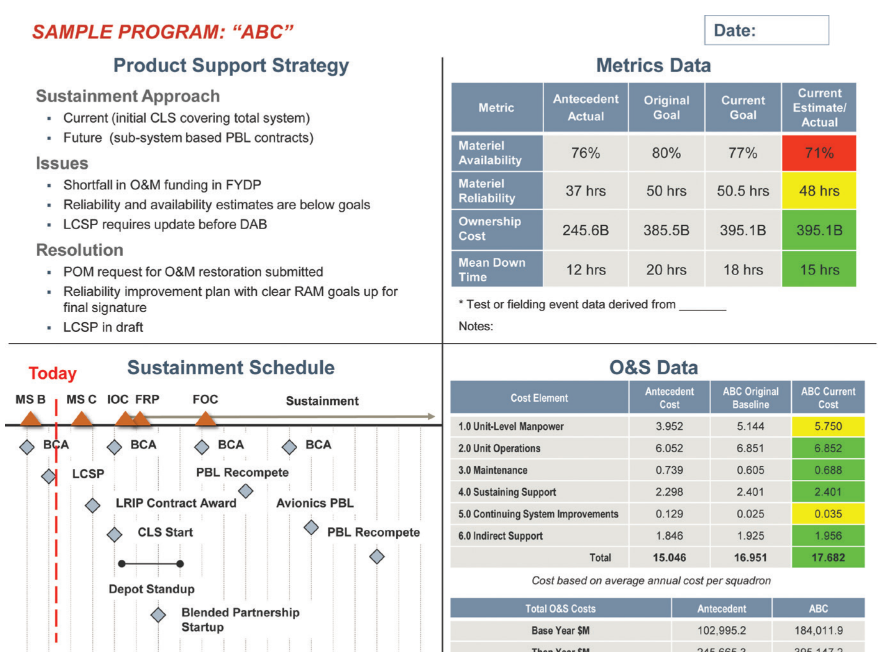
Figure 1. Sample Sustainment Quad Chart



Lesson 1-2

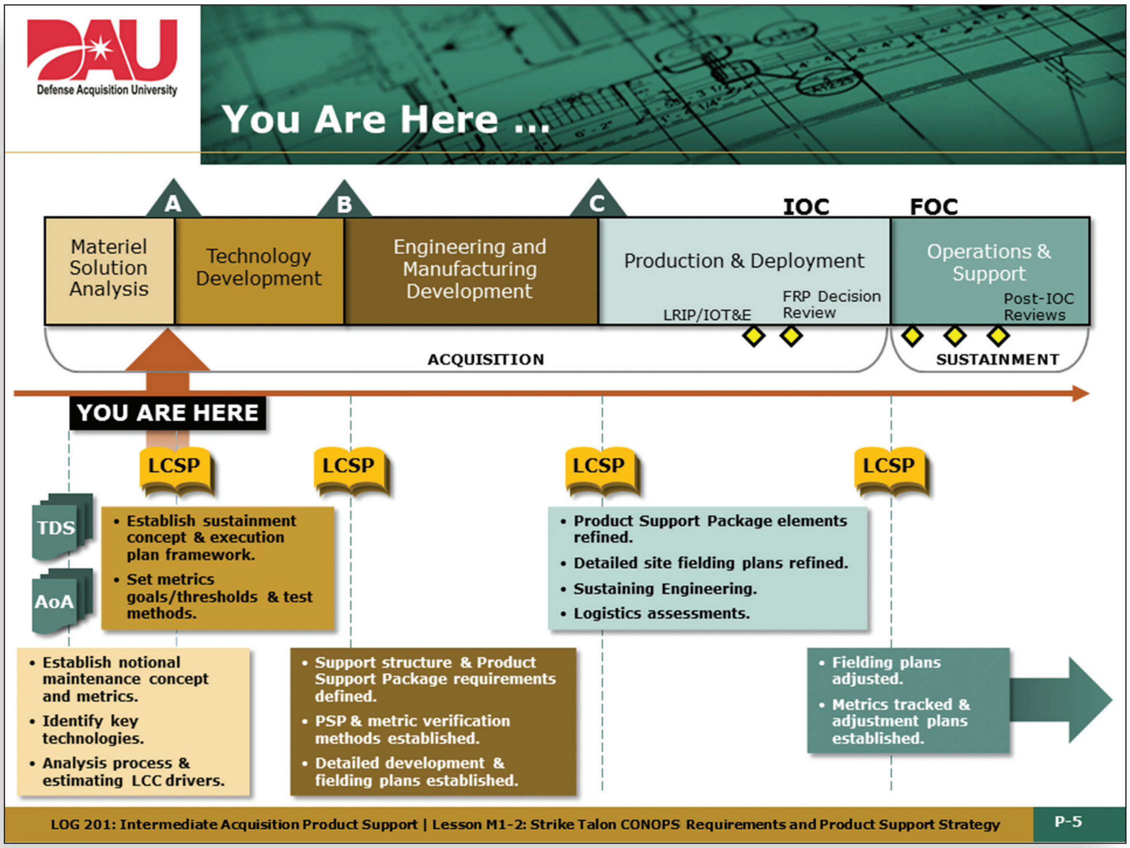
Strike Talon CONOPS, Requirements, and Life Cycle Sustainment Strategy

Lesson Objectives:

- Given program documents, identify the Strike Talon Concept of Operations (CONOPS).
- Given the Integrated Product Support (IPS) Elements and a program's Concept of Operations (CONOPS), assess the effect of the CONOPS on the Product Support Strategy.
- Given program, policy, and framework documents, identify the requirements (KPPs, KSAs and Product Support Arrangements (PSAs) for the Strike Talon Program.
- Given program, policy, and framework documents, apply requirements, boundaries, constraints, and opportunities to the program's Product Support Strategy.
- Given a Life Cycle Sustainment Plan (LCSP) outline, program, policy, and framework documents, document the Product Support Strategy.

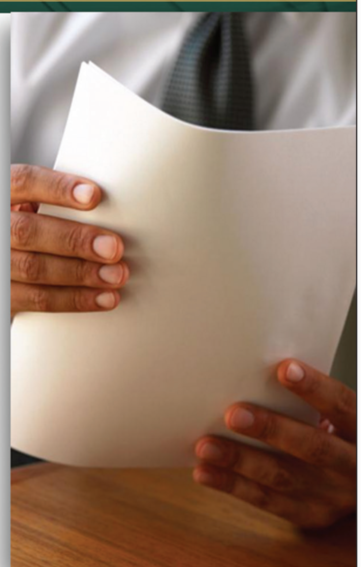
What's In It for Me?

- You will understand the importance of key program documents and their value to a LCL.
- You will understand how the Concept of Operations (CONOPS) shapes the Product Support Strategy.
- You will identify specific Strike Talon requirements and how they affect the program's Product Support Strategy.
- You will use the IPS Elements to develop the Life Cycle Sustainment Plan.
- You will start documenting the Product Support Strategy in a Life Cycle Sustainment Plan (LCSP).



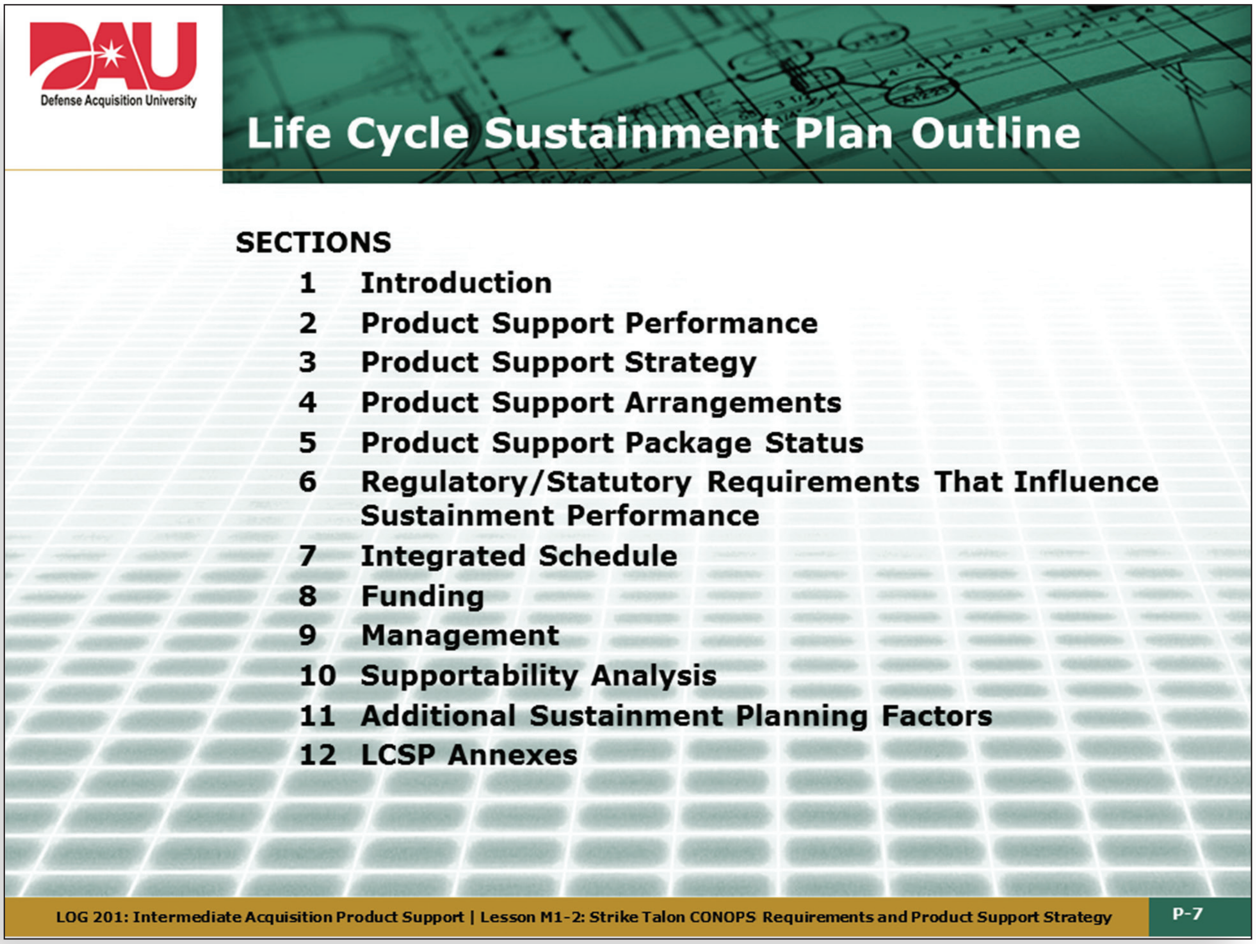
Key Program Documents

- **Acquisition Strategy (AS)**
  - Overall strategy
  - Specific targets per phase
- **Systems Engineering Plan (SEP)**
- **Test and Evaluation Master Plan (TEMP)**
- **Life Cycle Sustainment Plan (LCSP)**
  - Outline
  - Phase–specific targets–sections required by phase
  - Focus of this course



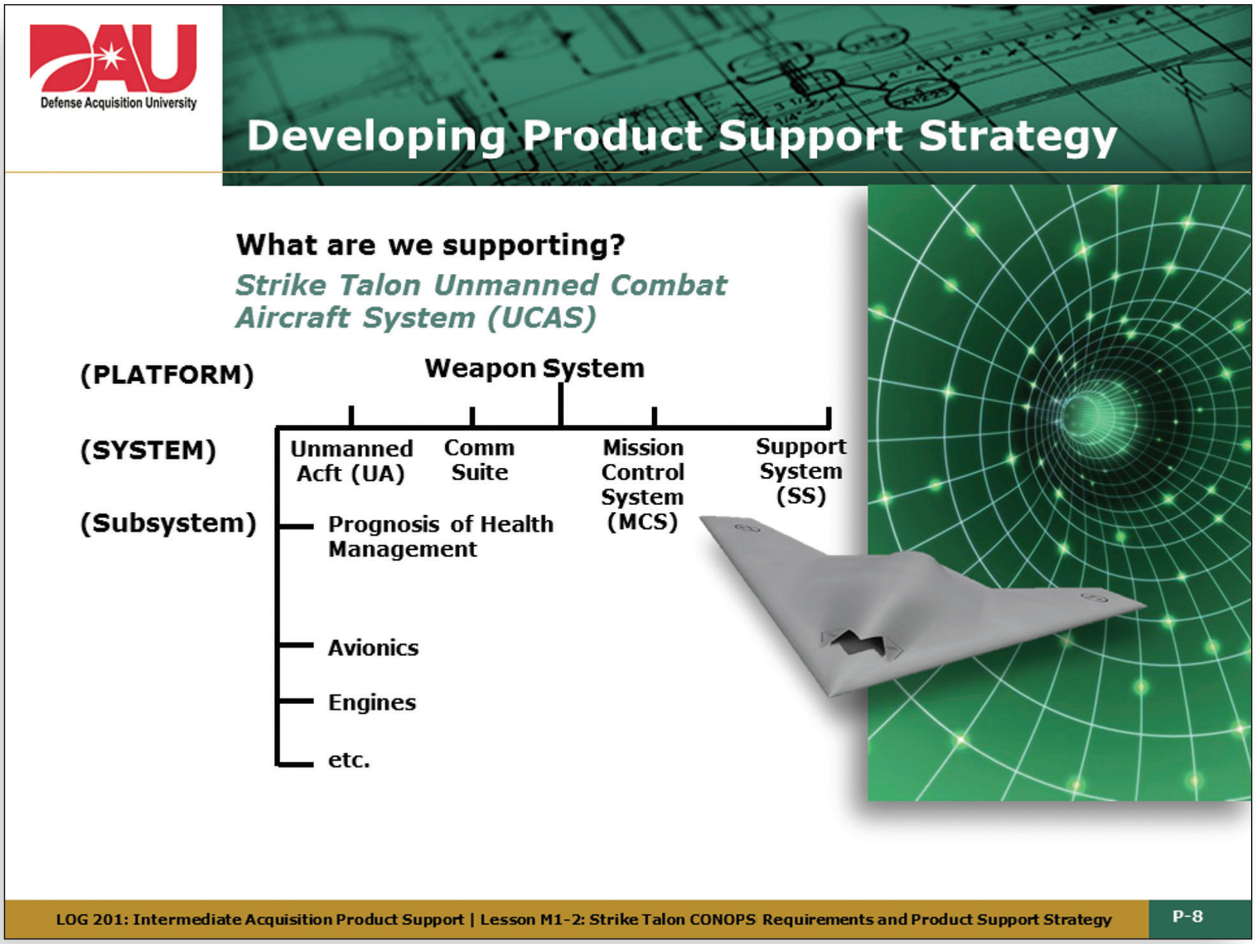
LOG 201: Intermediate Acquisition Product Support | Lesson M1-2: Strike Talon CONOPS Requirements and Product Support Strategy

P-6



Here are the sections of the LCSP. We'll briefly cover what is included in each section.

- Section 1: Introduction
- Section 2: Product Support Performance
- Section 3: Product Support Strategy
- Section 4: Product Support Arrangements
- Section 5: Product Support Package Status
- Section 6: Regulatory/Statutory Requirements That Influence Sustainment Performance
- Section 7: Integrated Schedule
- Section 8: Funding
- Section 9: Management
- Section 10: Supportability Analysis
- Section 11: Additional Sustainment Planning Factors
- Section 12: LCSP Annexes


Defense Acquisition University
Developing Product Support Strategy
What are we supporting?
Strike Talon Unmanned Combat Aircraft System (UCAS)
(PLATFORM)
Weapon System
(SYSTEM)
Unmanned Acft (UA)
Comm Suite
Mission Control System (MCS)
Support System (SS)
(Subsystem)
Prognosis of Health Management
Avionics
Engines
etc.
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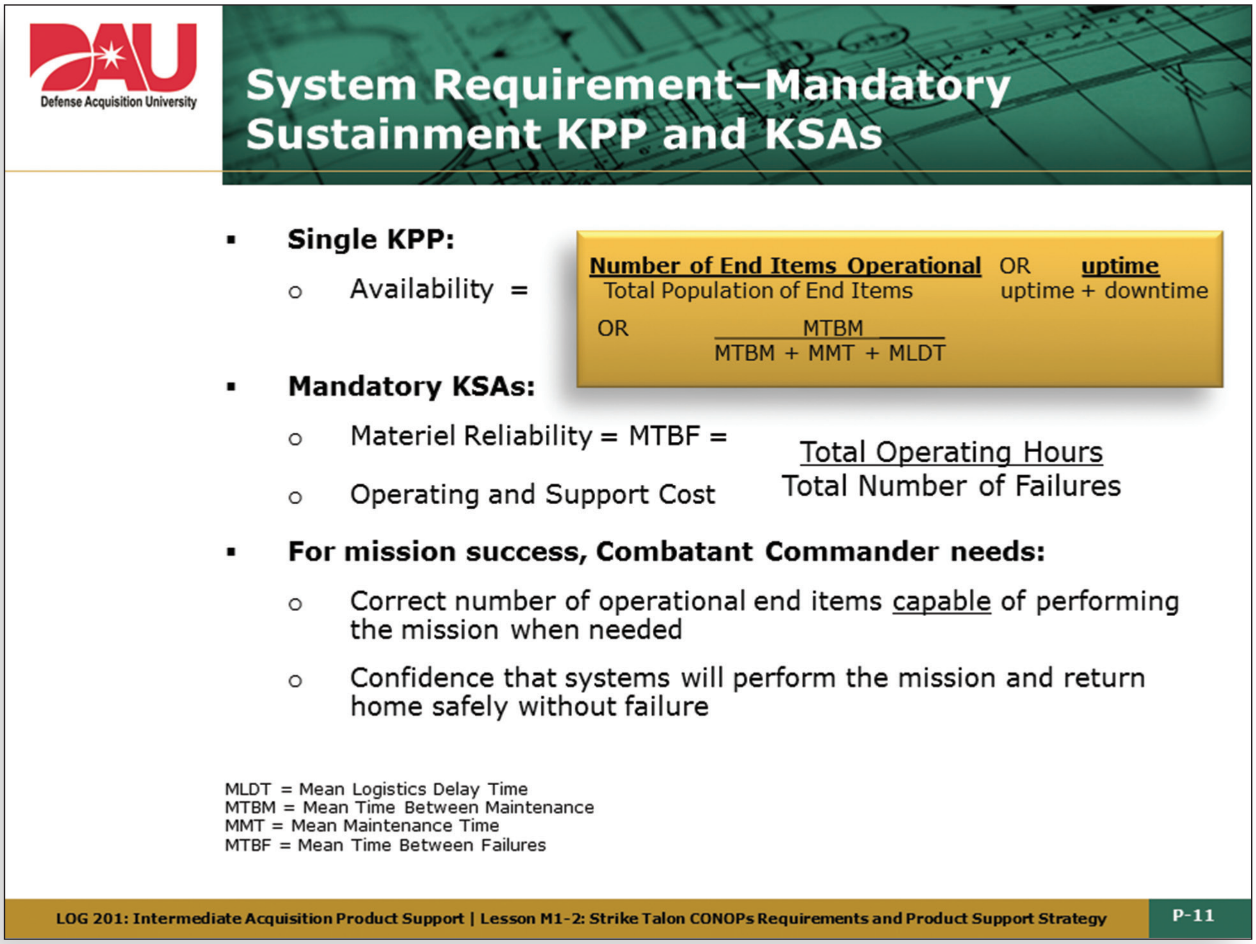
P-8

Notes:

Notes:

Student Exercise 1 (See Exercise Section. p. 93, for Exercise 1 instructions.)

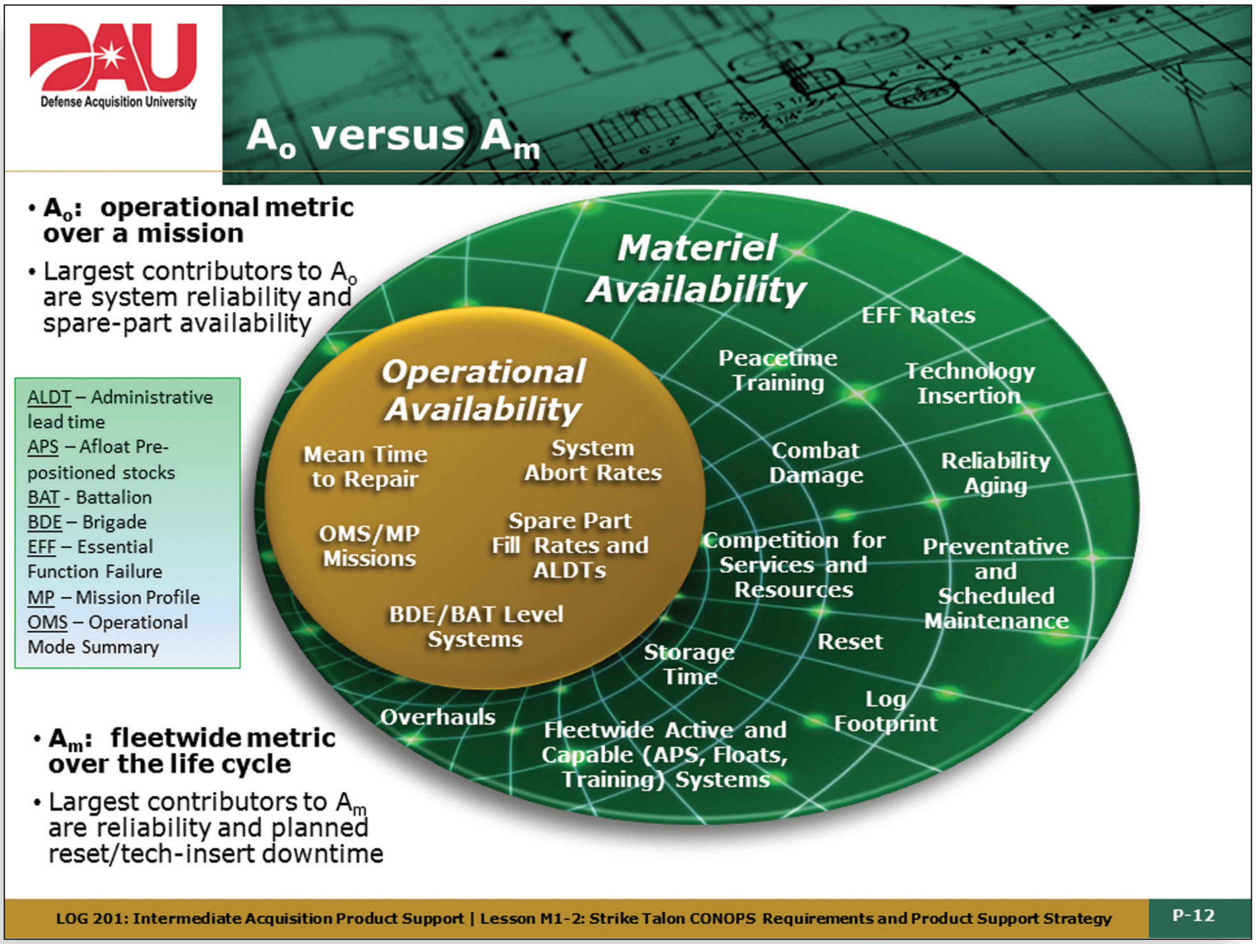


Notes:

We've identified the Strike Talon CONOPS. Now we need to understand the requirements. Requirements are in the form of KPPs and KSAs. There are mandatory sustainment requirements.

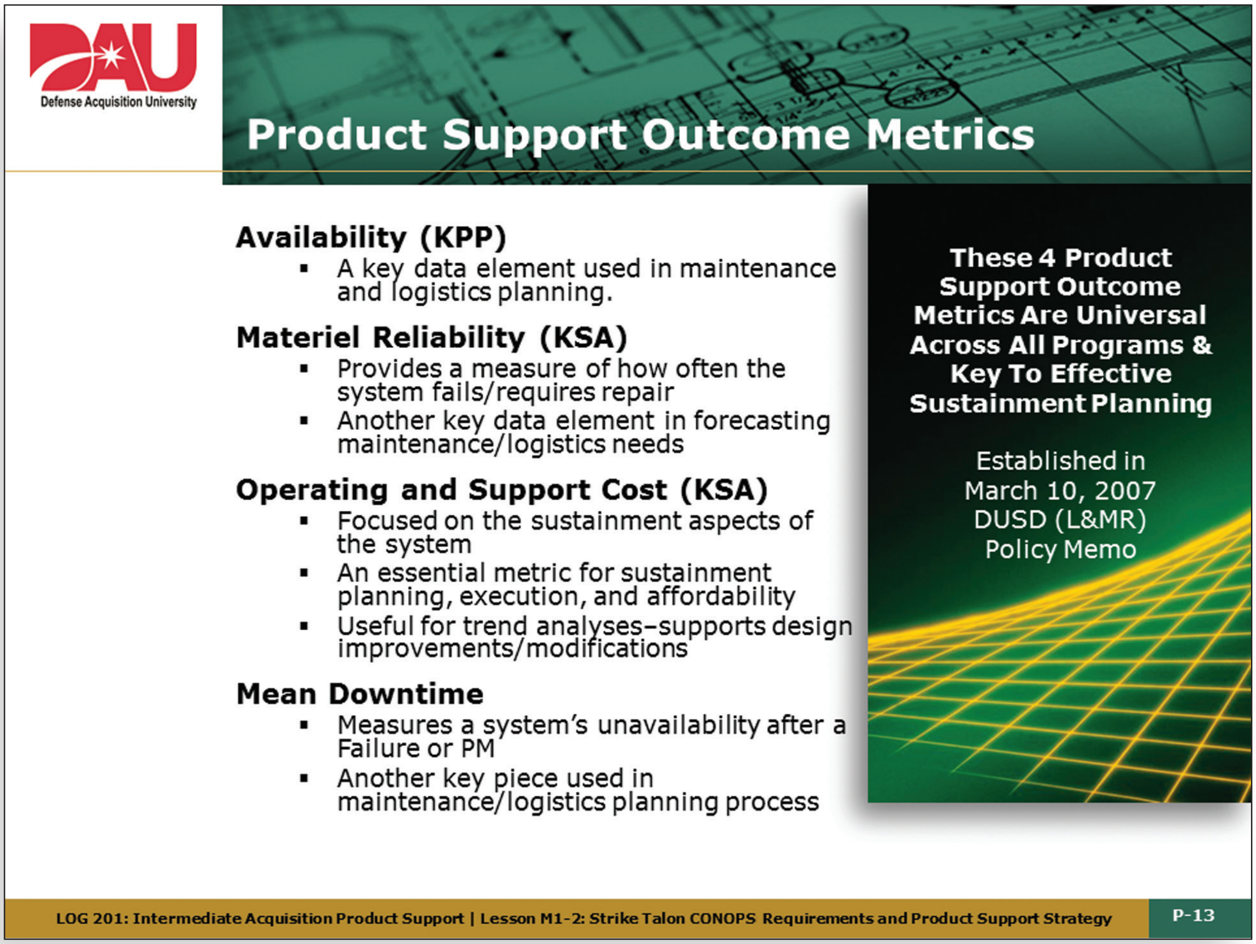
The mandatory sustainment KPP is ______________________________.

The mandatory sustainment KSAs are ___________ and ___________.

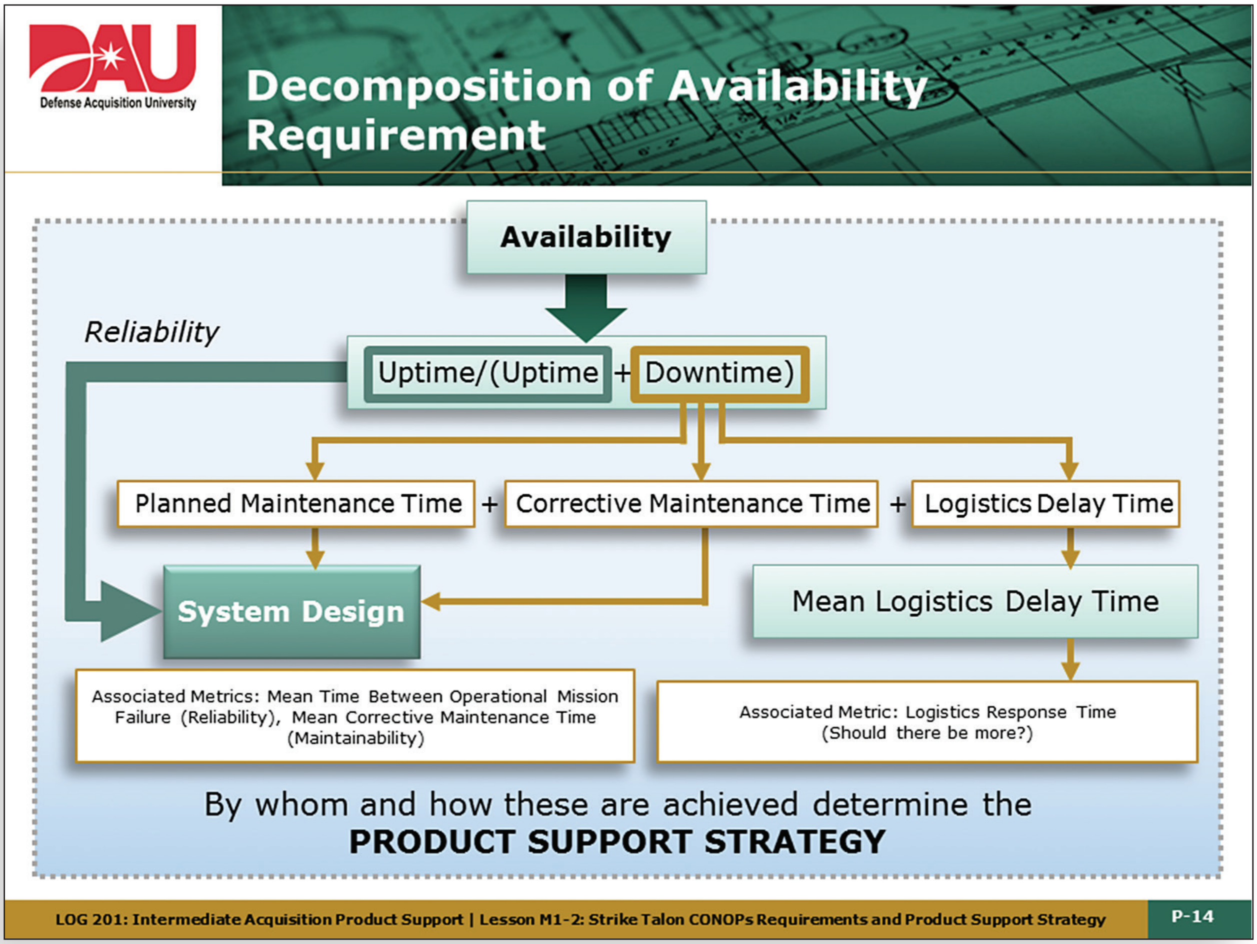


Notes:

Here's a way of looking at the two components of Availability—Operational Availability and Materiel Availability. Both must be met for the overall performance requirement of availability.



Notes: In addition to KPP and KSAs, the Assistant Secretary of Defense for Logistics and Materiel Readiness (Under Secretary of Defense for Acquisition, Technology and Logistics [USD(AT&L)]) identified the Product Support Outcome Metrics. These include the mandatory sustainment KPP and KSAs. It also adds a fourth metric, "Mean Downtime." You'll see these again when we discuss the "Sustainment Quad Chart" in Lesson 4-1.



Notes: There's a lot going on in this chart. The basic idea is to understand how lower-level metrics build to the top-level mandatory sustainment KPP, availability. This connection allows us to develop meaningful product support and helps us communicate to the PM how what we do directly affects performance.

Can you list other measures of reliability?

Maintainability?

What is logistics delay time?

Can you list other measures of logistics delay time?

So What Comes Next?

- **We Know We Have Specific Requirements.**
  - Where are they documented?
  - What do they mean to us in our Product Support Planning?
  - Where do we link to our Product Support Strategy and document these requirements?
- **LCSP.**
- **Let's take a look.**

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Life Cycle Sustainment Plan Outline

SECTIONS

1. **Introduction**
2. **Product Support Performance**
3. **Product Support Strategy**
4. Product Support Arrangements
5. Product Support Package Status
6. **Regulatory/Statutory Requirements That Influence Sustainment Performance**
7. Integrated Schedule
8. Funding
9. Management
10. **Supportability Analysis**
11. Additional Sustainment Planning Factors
12. LCSP Annexes

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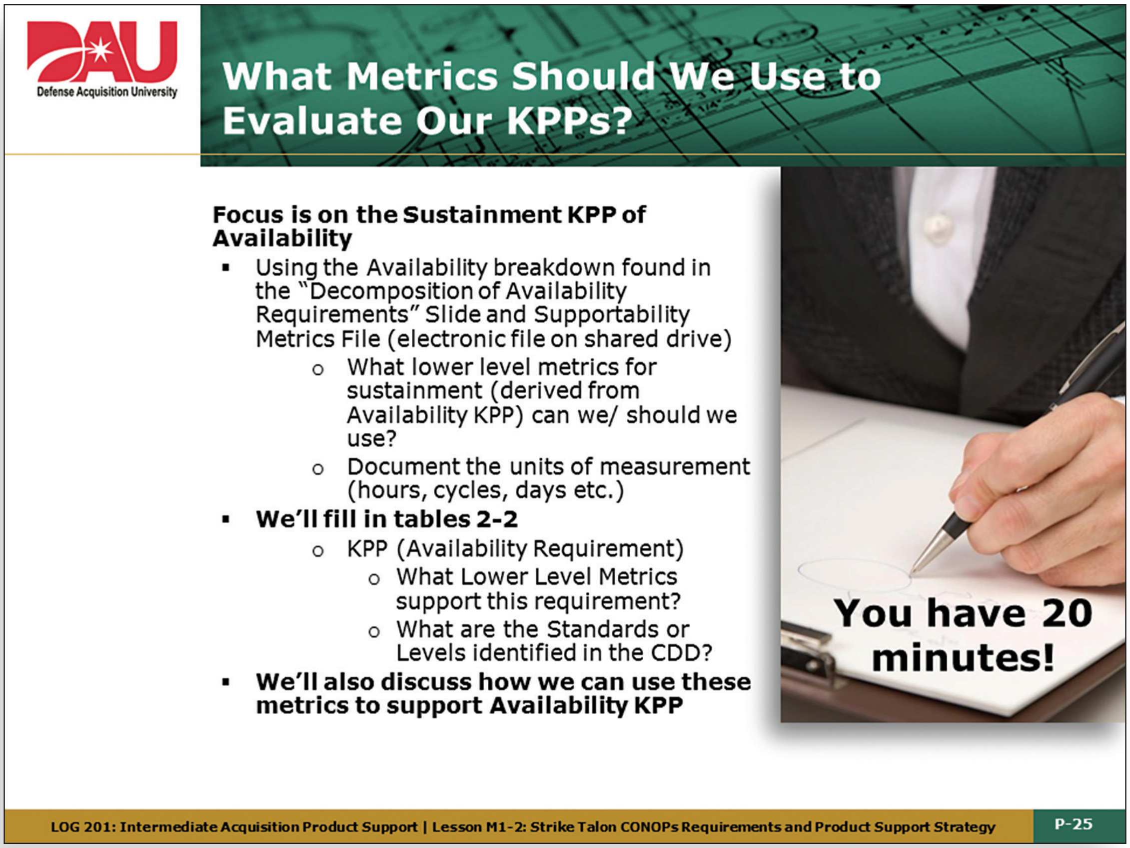
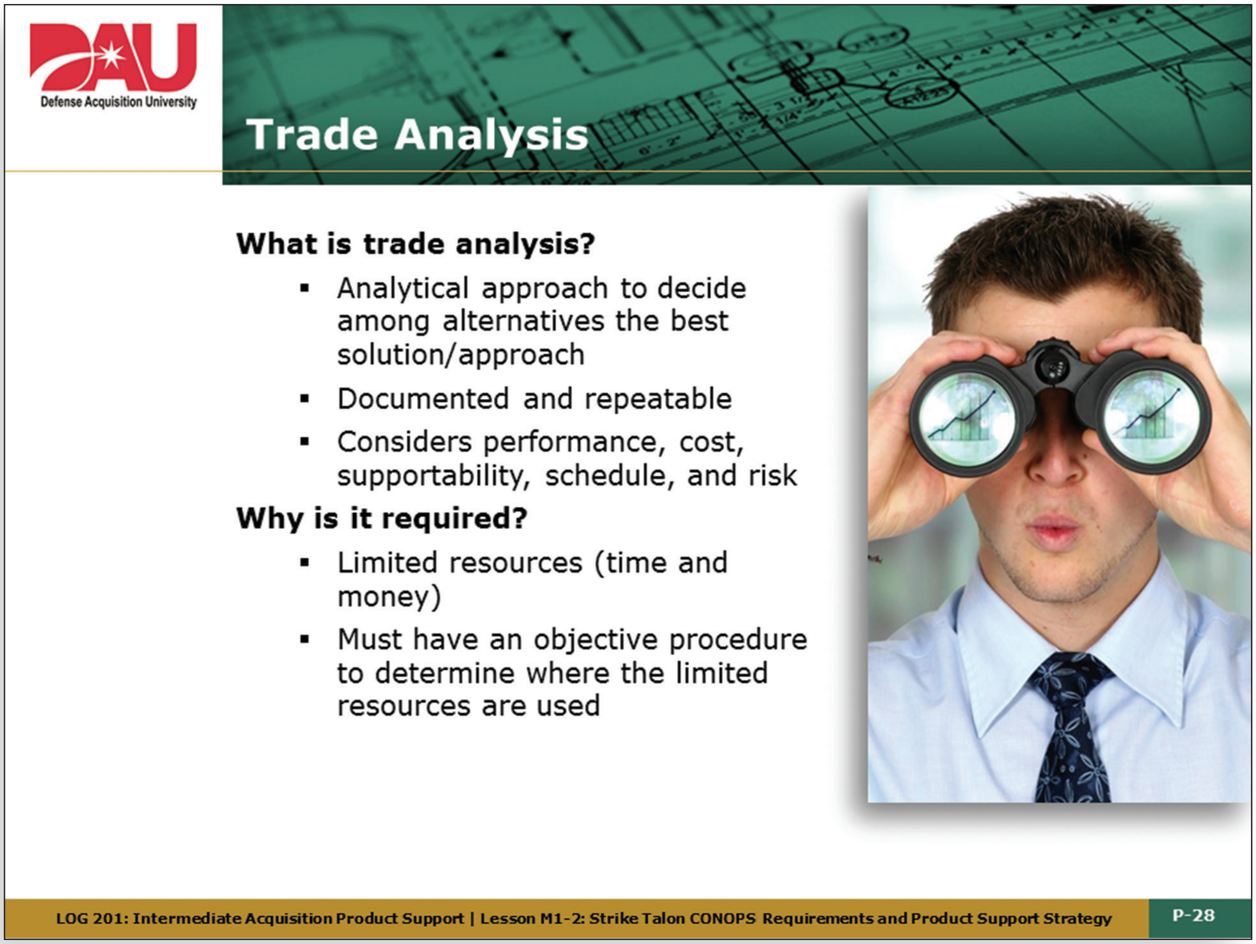
Student Exercises 2 (See Exercise 2 section, p. 94, respectively, for instructions and template.)





Notes:

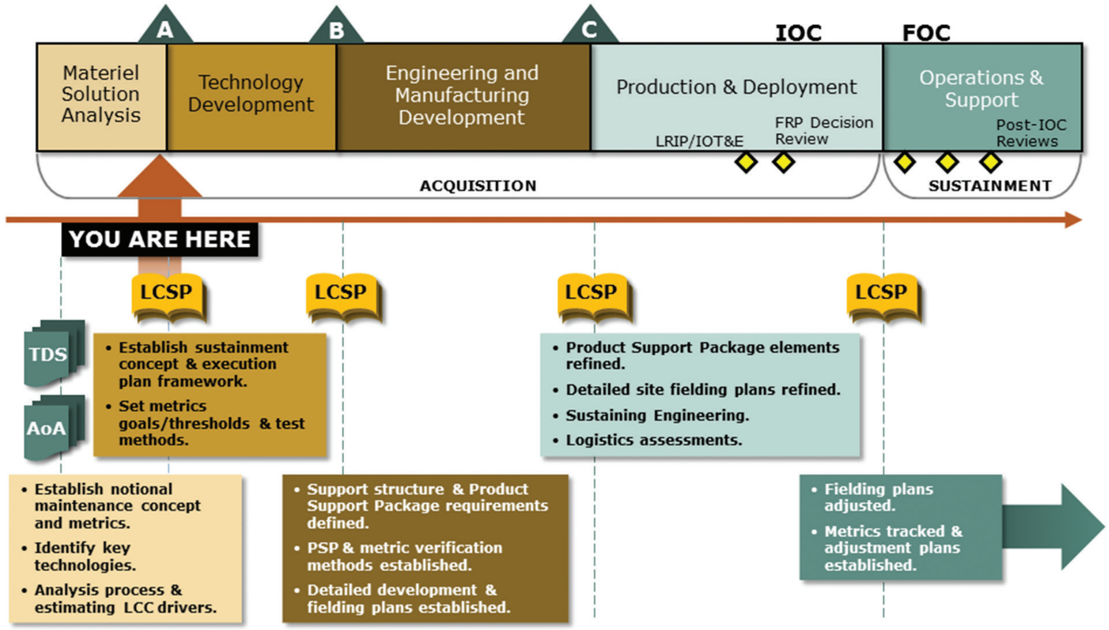
How do we use trade analysis?

How do we communicate to the PM the effect of trading one approach/solution for another?

- Cost
- Schedule
- Performance

And never forget risk. We'll discuss risk in more detail in Lesson 2-1: Technology Development and Logistics Risk.

You Are Here ...



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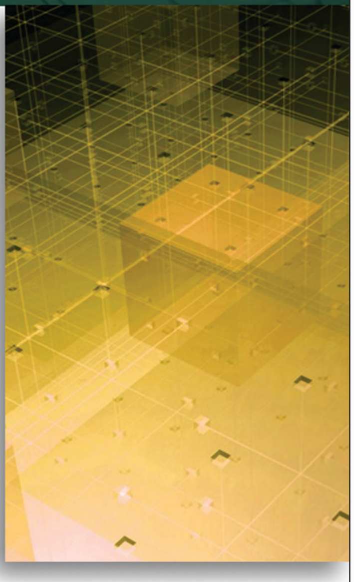
Summary

- You now understand the importance of key program documents and their value to a LCL.
- You now understand how CONOPS shapes the Product Support Strategy.
- You can identify specific warfighter requirements and how they affect a Product Support Strategy.
- You have started documenting the Product Support Strategy in a LCSP.
- You used the IPS Elements to develop the LCSP.



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Lesson 1-2 Exercises

These exercises focus on:

Identifying and understanding how the CONOPS and requirements affect our Product Support Strategy and planning. This also is our first opportunity to take requirements information and start building our LCSP. In Exercise 1, you review the CONOPS for Strike Talon and answer questions about the system. Exercises 2 and 3 focus on the requirements (i.e., KPPs and KSAs) and metrics for Strike Talon.

Exercise 1:

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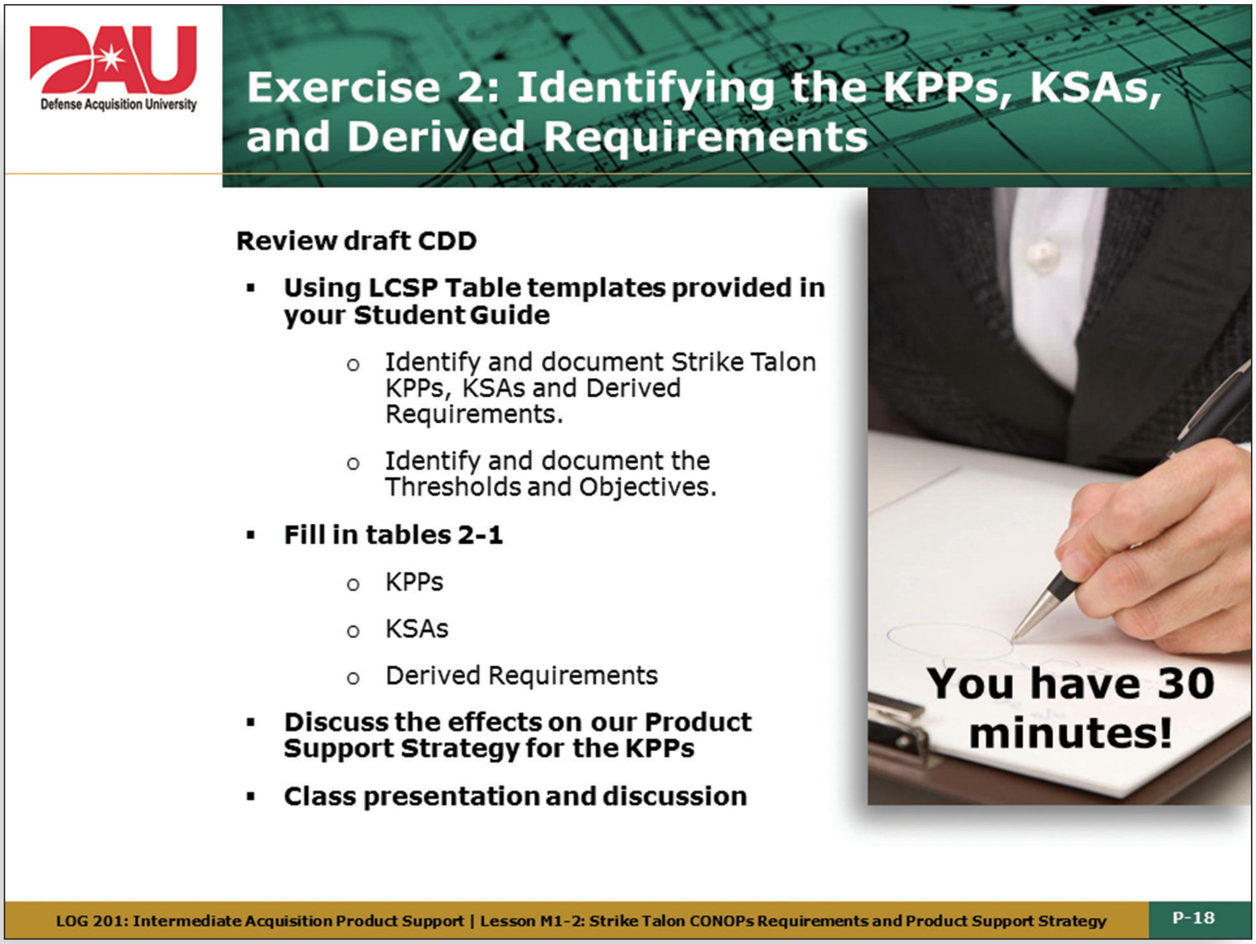
Exercise 1: Strike Talon CONOPs

- **Review draft CDD**
- **Answer the following questions**
  - What is the Strike Talon CONOPs?
    - Team 1→ What is system expected to do (e.g. how many orbits per squadron)?
    - Team 2→ Where will it operate?
    - Team 3→ Who will operate (service, personnel)?
    - Team 4→ What missions will it perform?
    - Team 5→ And most importantly, why do we care?
  - List the questions you have regarding impact to product support strategy
  - Class presentation and discussion

LOG 201: Intermediate Acquisition Product Support | Lesson M1-2: Strike Talon CONOPs Requirements and Product Support Strategy

P-10

Exercise 2:


Defense Acquisition University
Exercise 2: Identifying the KPPs, KSAs, and Derived Requirements
Review draft CDD
Using LCSP Table templates provided in your Student Guide
Identify and document Strike Talon KPPs, KSAs and Derived Requirements.
Identify and document the Thresholds and Objectives.
Fill in tables 2-1
KPPs
KSAs
Derived Requirements
Discuss the effects on our Product Support Strategy for the KPPs
Class presentation and discussion
You have 30 minutes!
LOG 201: Intermediate Acquisition Product Support | Lesson M1-2: Strike Talon CONOPs Requirements and Product Support Strategy
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Requirement (KPP, KSA, Derived Requirement)	Documentation	Threshold/ Objective
	Draft CDD, Paragraph 6.1.2, Table B	
	Draft CDD, Paragraph 6.1.2, Table B and Paragraph 6.2.2	
	Draft CDD, Paragraph 6.1.2, Table B and Paragraph 6.2.3	
	Draft CDD, Paragraph 6.1.2, Table B (Removed)	
	Draft CDD, Paragraph 6.1.2, Table B	
	Draft CDD, Paragraph 6.1.2, Table B and Paragraph 6.2.6	
	Draft CDD, Paragraph Table C	

Requirement (KPP, KSA, Derived Requirement)	Documentation	Threshold/ Objective
	Draft CDD, Paragraph 15.2.3	
	Draft CDD, Paragraph 6.3.1.2.2	
	Draft CDD, Paragraph 6.3.1.2.3	
	Draft CDD, Paragraph 6.3.1.10.1	
	Draft CDD, Paragraph 6.2.6.1.1	
	Draft CDD, Paragraph 13.5.2	
	Draft CDD, Paragraph 13.6.1	

Reading

"The Life Cycle Sustainment Plan: A Review of the Annotated Outline" by Terry Emmert, *Defense AT&L* magazine, March–April 2012.

The Life Cycle Sustainment Plan

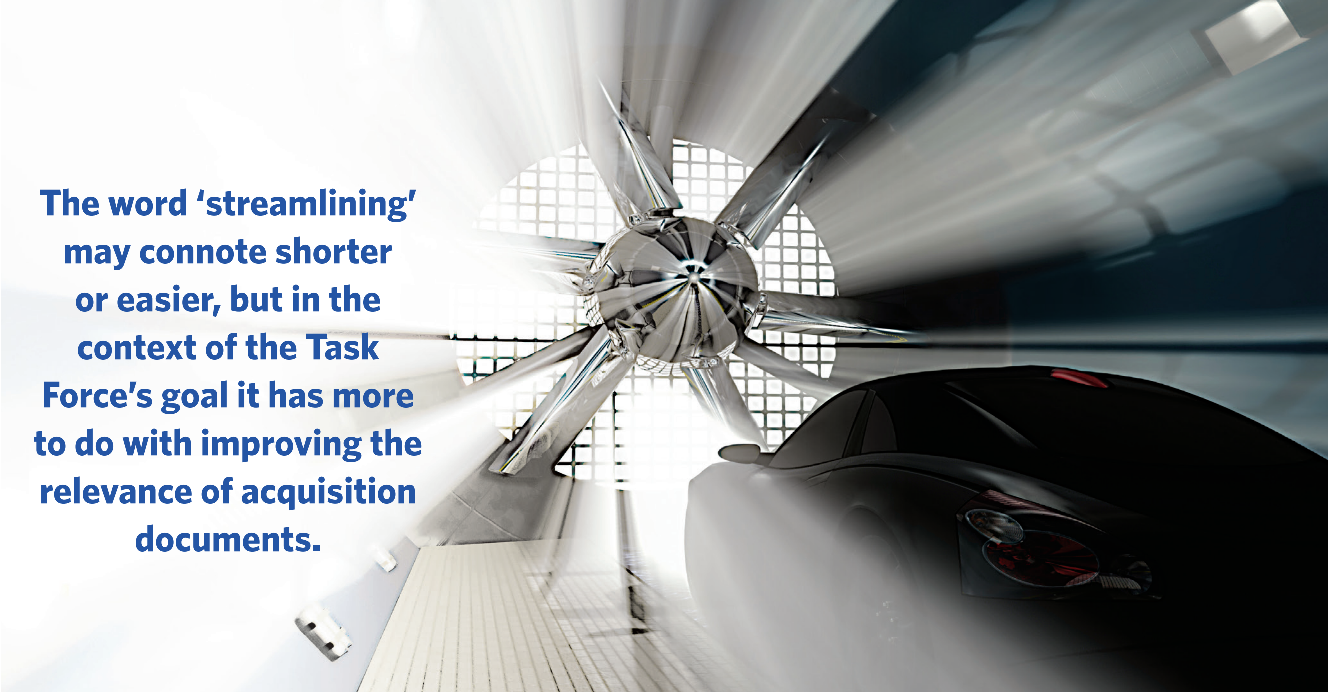
A Review of the Annotated Outline

Terry Emmert

In late 2011, the principal deputy under secretary of Defense for acquisition technology and logistics furnished direction on the information content and format for the life cycle sustainment plan (LCSP). Although LCSPs have been in use for some time under a variety of names, this direction was intended to improve the document's utility for all stakeholders in life cycle product support. Several major defense acquisition programs have now been through a variety of milestone decisions using the new LCSP outline. So this is a good time take stock of where we've been and where we're going with the refinement of the LCSP as a stand-alone decision support document and useful tool for programs in product support planning.

Emmert, *branch chief for policy at the Office of the Deputy Assistant Secretary of Defense for Materiel Readiness, has 23 years of experience in logistics and product support in commercial and DoD organizations.*


STREAMLINING



The word 'streamlining' may connote shorter or easier, but in the context of the Task Force's goal it has more to do with improving the relevance of acquisition documents.

The PDUSD(AT&L) chartered an Acquisition Document Streamlining Task Force in 2010, with the following goal:

> "Eliminating non-value added content [from acquisition documents] while simultaneously increasing their value to the preparing organizations and senior decision makers…all of our required documents should be of utility to those directly responsible for planning, managing, and conducting our programs…If the various plans and reports we require adequately serve this purpose, then they should be sufficient for [milestone] reviews."

It is worth clearing up any misconceptions about the term "streamlining." The word may connote shorter or easier, but in the context of the task force's goal, it has more to do with improving the relevance of documentary information. For acquisition documents, information must be relevant in servicing at least two critical needs: those of program manager and those of the milestone decision authority in making the right business decision. Although these needs evolve throughout the acquisition process, they must complement one another for the acquisition process to work. The impetus behind the Streamlining Task Force was to reverse a trend in which programs expended significant effort preparing acquisition documents solely for the purpose of a milestone decision review, only to have those documents fail to support the information needs of the decision maker. So if there are instances in which neither the program nor the decision maker derives value from the production of acquisition documents, that would seem to be an opportunity for improvement.

The task force's approach was to build an initial set of outlines for four critical acquisition documents (the technology development strategy/acquisition strategy, the systems engineering plan, the program protection plan, and the life cycle sustainment plan), that provide specificity in the minimum information required to serve both the needs of program and the decision maker. Additionally, the outlines provide guidance on a format for presenting the information so that it is easily captured and easily consumed. Format is important, because one of the key dynamics with the non-value-added documents was the extensive use of narrative and descriptions, which increased page counts but not necessarily clarity. This is why you'll see in the outlines extensive use of tables, graphs, and lists, with the intent of making the information more easily produced, maintained, and consumed, at the program and decision-maker levels.

The LCSP was among this first group of outlines the Streamlining Task Force produced. While the streamlining effort was focused on efficiency in the acquisition process, a theme emphasized in the USD(AT&L) Better Buying Power initiatives, the LCSP has assumed a much larger purpose in the past 2 years, as the emphasis on affordability has grown. In the current and projected budget environment, an acquisition program's survival depends on its demonstrating, unambiguously, that its plan for sustainment satisfies the warfighter requirements and is affordable for the taxpayer. The LCSP therefore focuses on aligning three dynamics: 1) the needs of the warfighter, 2) what the Service(s) can afford in the context of the portfolio of capability, and 3) the program's strategy and plan for satisfying (1) and (2).

The first area addressed in the outline is the warfighter's requirements, with specific emphasis on sustainment metrics and elaboration on these metrics. This helps the program factor supportability into the system design and the design of the product support package. Product support strategy comes next. This is where the program delineates, at a high level, how it will allocate sustainment functions among organic and commercial providers. Strategy is then refined into plans through the definition of product support arrangements among commercial contracts.

The LCSP outline then addresses the individual product support elements, but only at a review and assessment summary level. What about the detailed implementation plans, you might ask? The task force deliberately constrained this section for a couple of reasons. First, implementation plans could be voluminous, introducing a level of detail that at this point in the document would detract from the goal of the aligning the three dynamics discussed above. Second, detailed implementation plans entail a degree of Service specificity, and the task force did not believe that driving a standardized approach supported the two main objectives: providing a program tool first and milestone decision support second. This is not to say that implementation plans don't have a place in the LCSP. The annex section at the end of the outline was included to provide a place for greater detail needed by the specific program or Service.

The outline provides a place to document the statutory and regulatory requirements that impact sustainment planning, but the key here is the alignment among these requirements and the performance requirements of the program. Next in the LCSP is the integrated schedule, which is specifically focused on product support activities and deliverables, and must align with the program's integrated master schedule.

Funding is covered next in the outline. This section is critical in addressing the affordability dimension of the three dynamics. Here is where the program details its sustainment specific funding requirements and assesses any gaps. It goes without saying that the current economic situation will likely turn any discussions of closing gaps with *more* funding into spirited dialogs, to say the least.

The LCSP outline then shifts to the program's management approach, drilling down to the structure, roles and responsibilities of the program's product support organization. This section describes the membership and objectives of the Sustainment IPT. Ideally, the LCSP is not just a product of the Sustainment IPT, but the central management tool used by this team and its leader, the product support manager. Key to the management approach is the program's method for managing sustainment risks, in the context of the overall program risk management process. The final section of the outline addresses supportability analysis from three aspects: design interface, product support package determination, and sustaining engineering.

As mentioned earlier, the content of the LCSP outline was intended to furnish the minimum essential information. Accordingly, the outline provides a section at the end for planning factors and annexes which the PM may need to ensure the tactical utility of the document.

In many cases the task force provided notional information to stimulate the writer's thinking as pen meets paper on a program's initial LCSP. More to the point, the actual data in the document must be relevant and specific to the unique program, if it is to be useful to the program; the notional charts and data in the outline are thus representational, illustrative only.

The LCSP is intended to serve as the nexus of critical thinking among stakeholders, united in the goal of delivering affordable product support. Those stakeholders exist within the program: think in terms of systems engineering, contracting, and financial management. External stakeholders might include such product support providers as depots, DLA, the Service's retail supply system, or industry partners.

Commercial providers may be internal or external depending on where the program is in the contracting process. When a program begins to formulate the RFP for commercial product support services, the LCSP becomes an even more critical tool. The type of contract is guided by the stability of the product design and the maturity of the product support package, which is documented in the LCSP. The performance work statement is guided by the product support strategy, and incentives must support the performance metrics. Again, all captured in the LCSP. A robust LCSP is, in other words, the key tool in documenting and translating product support and sustainment requirements into effective contracts.

The LCSP Outline can be found at https://acc.dau.mil/lcsp-outline. The Acquisition Community Connection product support website is https://acc.dau.mil/productsupport.

Beyond being a good reference that informs RFP development, there are sections from the LCSP that might be good background to include directly in the solicitation, such as the sustainment requirements, the product support strategy or portions of the schedule, although other sections, such as funding data, might not be appropriate. Some portions of the LCSP might be developed by the prime, such as the detailed plan for supportability analysis, or specific product support implementation plans, but always in the context of the overall Life Cycle Sustainment Plan, the development of which is unequivocally a governmental function.

The real measure of success for the deployment of the LCSP is its comprehensive use as a management tool within the program and among the program and its key stakeholders. To be useful in this context, the plan must align requirements, strategy, costs, and affordability. The "win-win" is that this same information is needed for sound acquisition decisions and ultimately the delivery of optimized sustainment outcomes.

The author can be reached at **terry.emmert@osd.mil**.

Homework

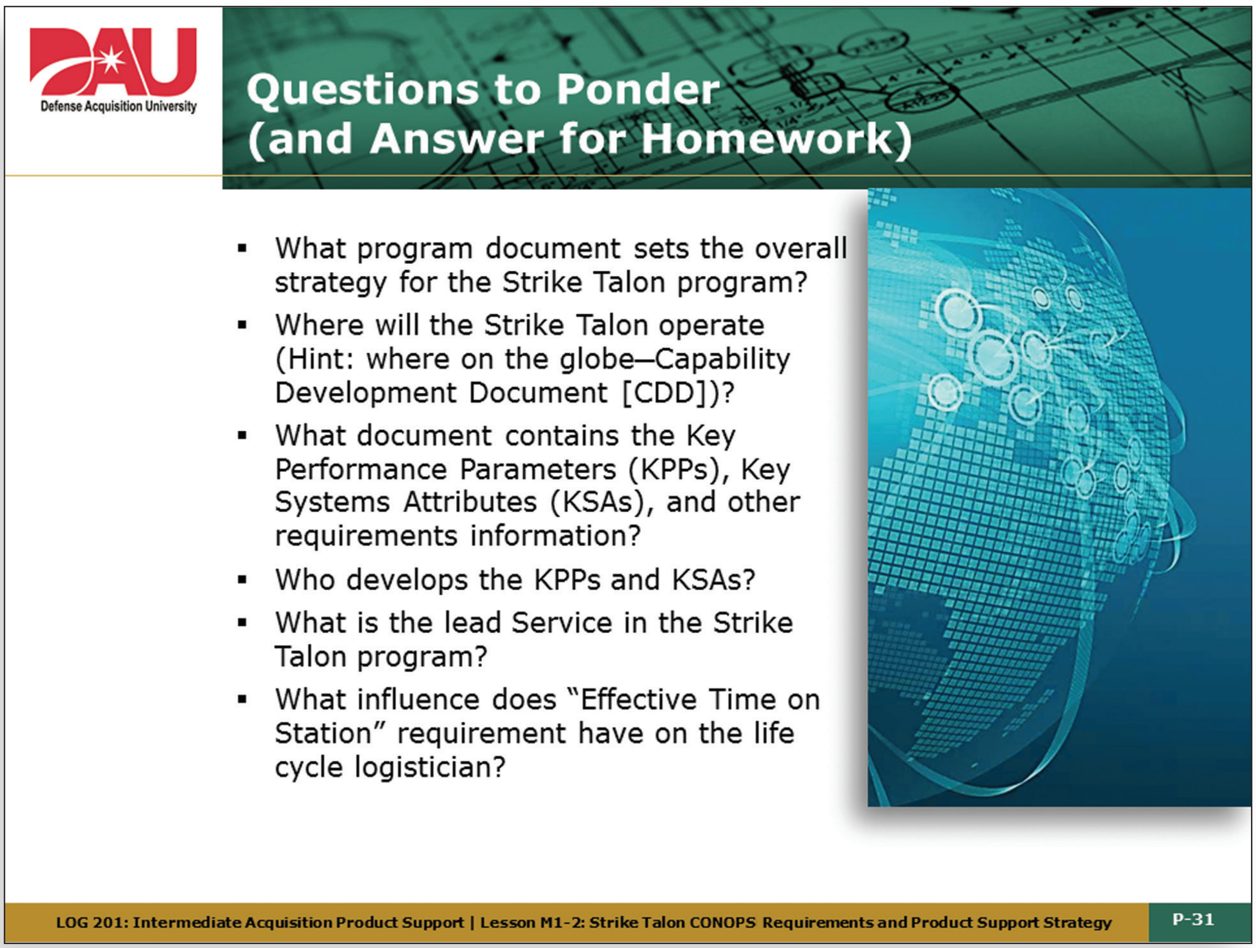
Read:

Lesson 2-1 Reading Section:

Excerpt from *Risk Management Guide for DoD Acquisition,* Sixth Edition, August 2006

Lesson 2-2 Reading Section:

Supportability Analysis Student Reading



Questions to Ponder (and Answer for Homework)

- What are the 4 major systems of the Strike Talon?
- How many UCAS squadrons will be fielded for the Navy? For the Air Force (Hint: CDD)?
- What is the expected system life (Hint: CDD)?

Also complete reading (in your Student Guide) for Lessons 2-1 and 2-2:

- Excerpt from *Risk Management Guide for DoD Acquisition*, Sixth Edition, August 2006 (M 2-1)
- Supportability Analysis Student Reading (M 2-2)

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Lesson 2-1

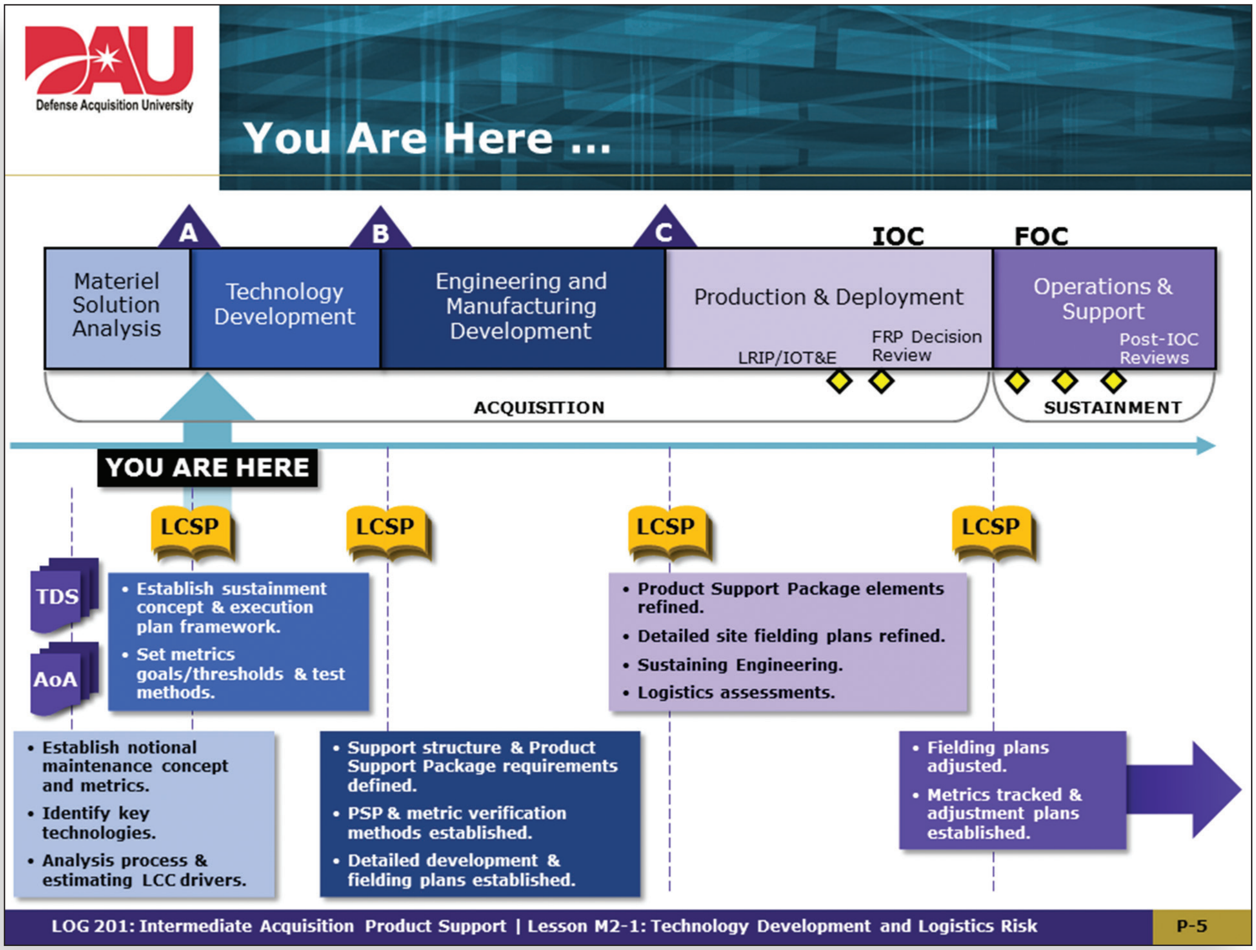
Technology Development and Logistics Risk

Lesson Objectives:

- Given technology readiness level definitions, Strike Talon Prognostics Health Management (PHM) subsystem commercial off-the-shelf (COTS) component data and the Integrated Product Support Elements, determine the logistics risk for selected components.
- Given information on COTS components, market research, the Integrated Product Support Elements, and logistics risk, determine an effective risk management approach.
- Given a Life Cycle Sustainment Plan (LCSP) outline, program, policy, and framework documents, describe the process of using test data to reduce logistics risk.
- Given a Life Cycle Sustainment Plan (LCSP) outline, program, policy, and framework documents and risk evaluation, update the LCSP.

What's In It for Me?

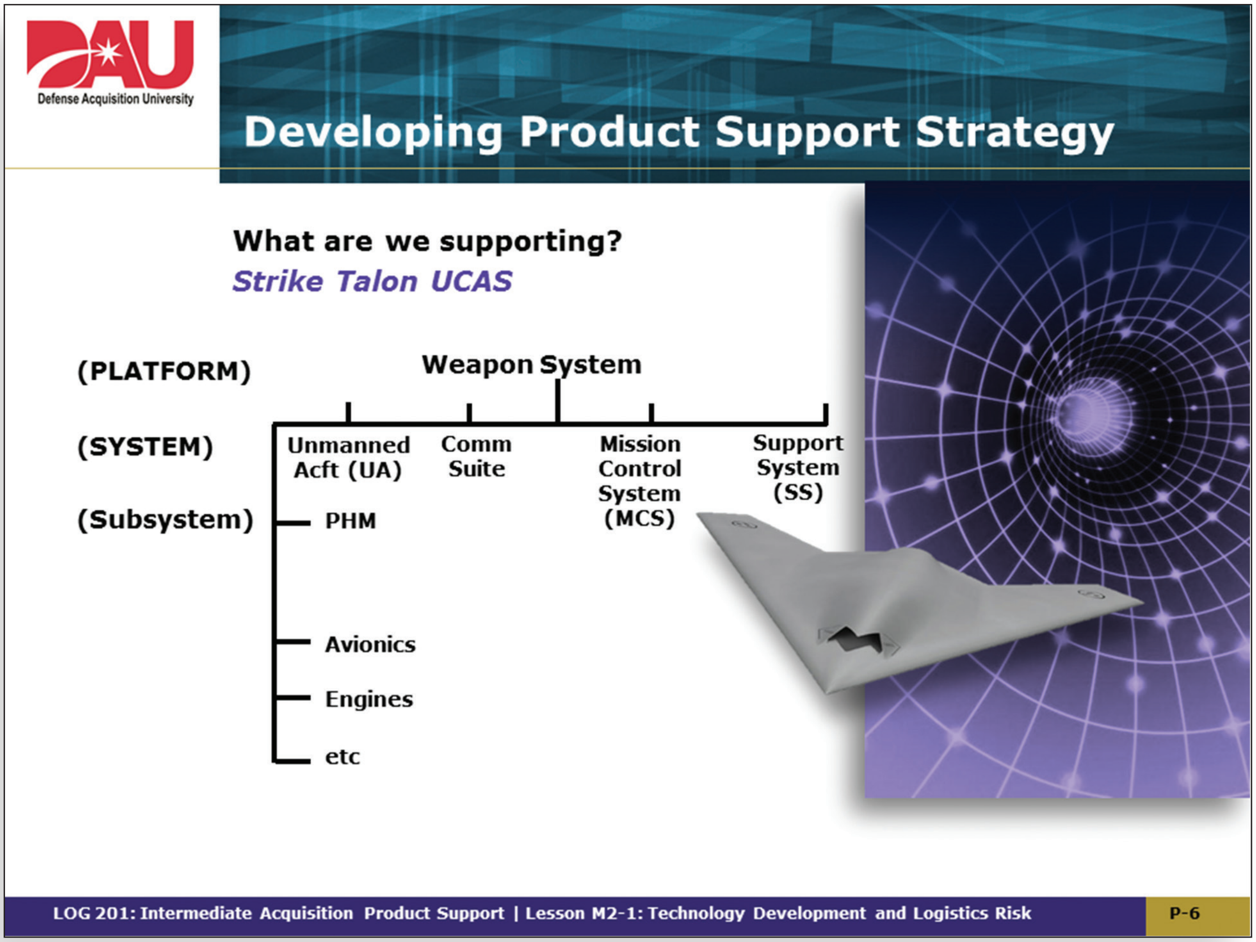
- You will understand the need for a strategy to mature technology.
- You will be able to identify data needed to assess technological maturity.
- You will evaluate the logistics risk presented by immature technology and develop approaches to manage the logistics risk.
- You will update the LCSP for the beginning of the Technology Development Phase to include Integrated Product Support Elements and risk assessments.
- You will understand what drives the initial formulation of your Product Support Strategy.



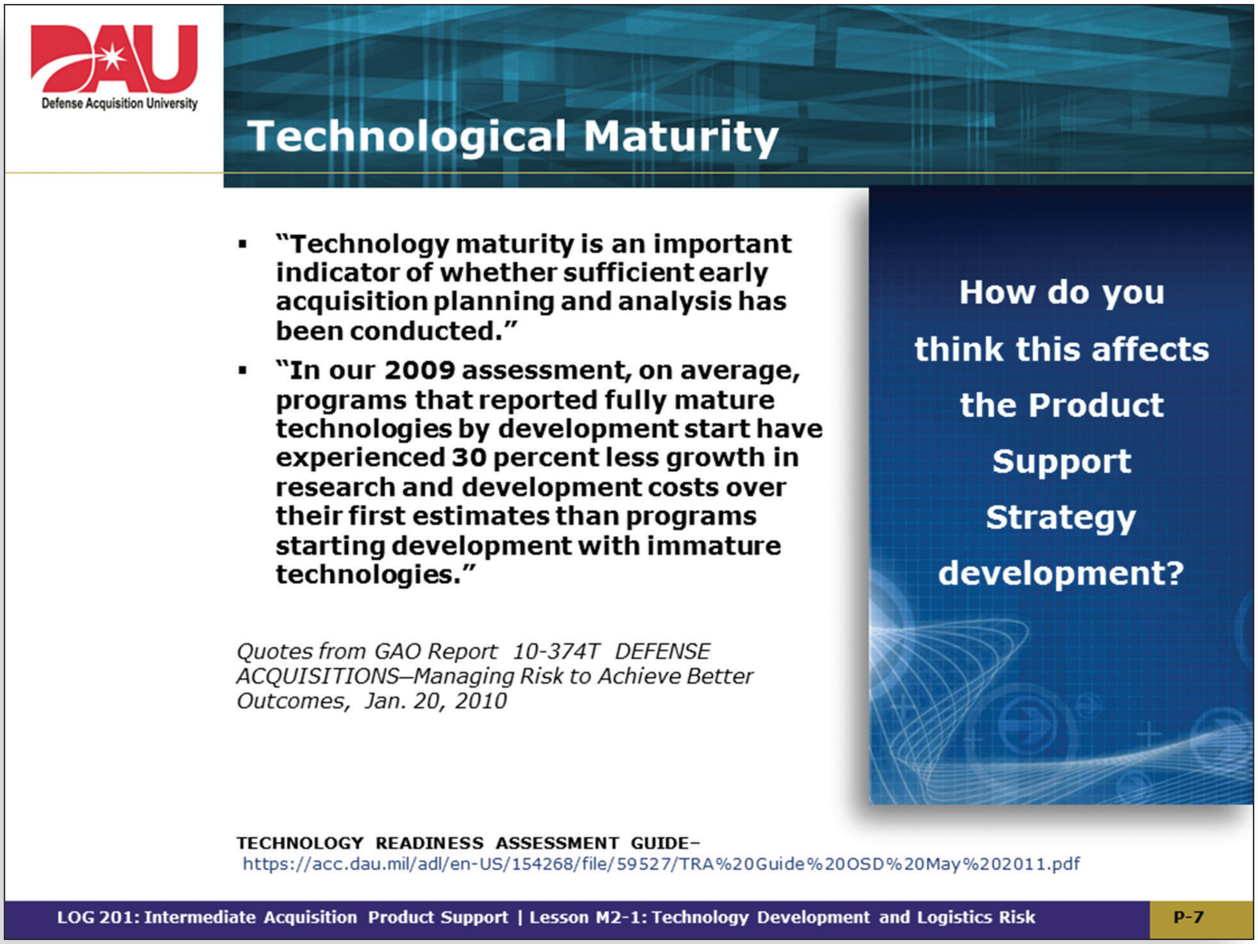
Notes:

We are now in the Technology Development Phase. The Integrated Product (Process) Team is building the Technology Development Strategy.

What does Strike Talon look like at this point?



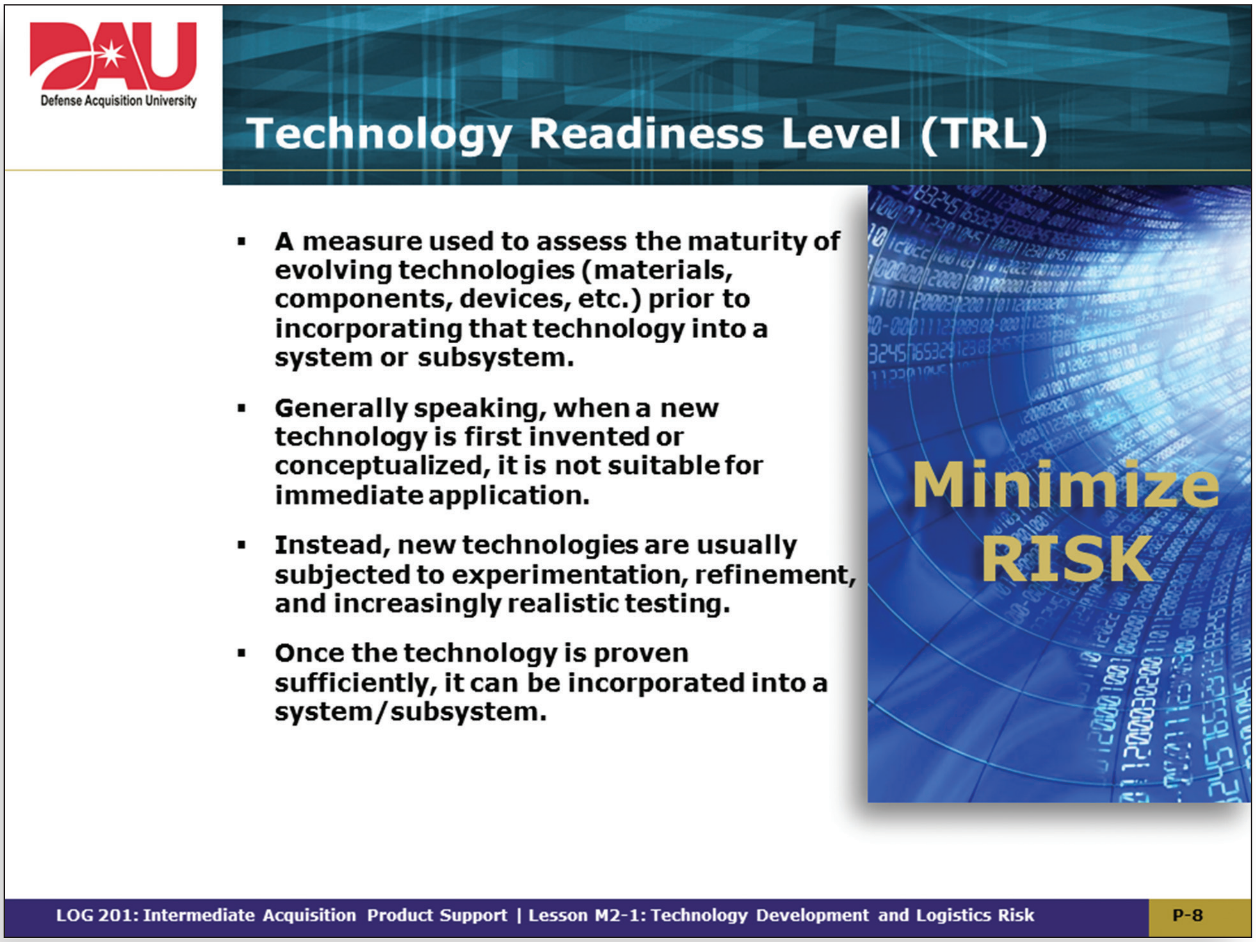
This lesson will evaluate risk with regard to technological maturity (and what we should do about it). We will get specific with a maintenance concept in Lesson 2-2.



Notes:

Note the emphasis on mature technology and its effect on programs. What does this mean to us if technology is not sufficiently mature?

How does this affect our Product Support Strategy and Life Cycle Sustainment Planning?



Notes:

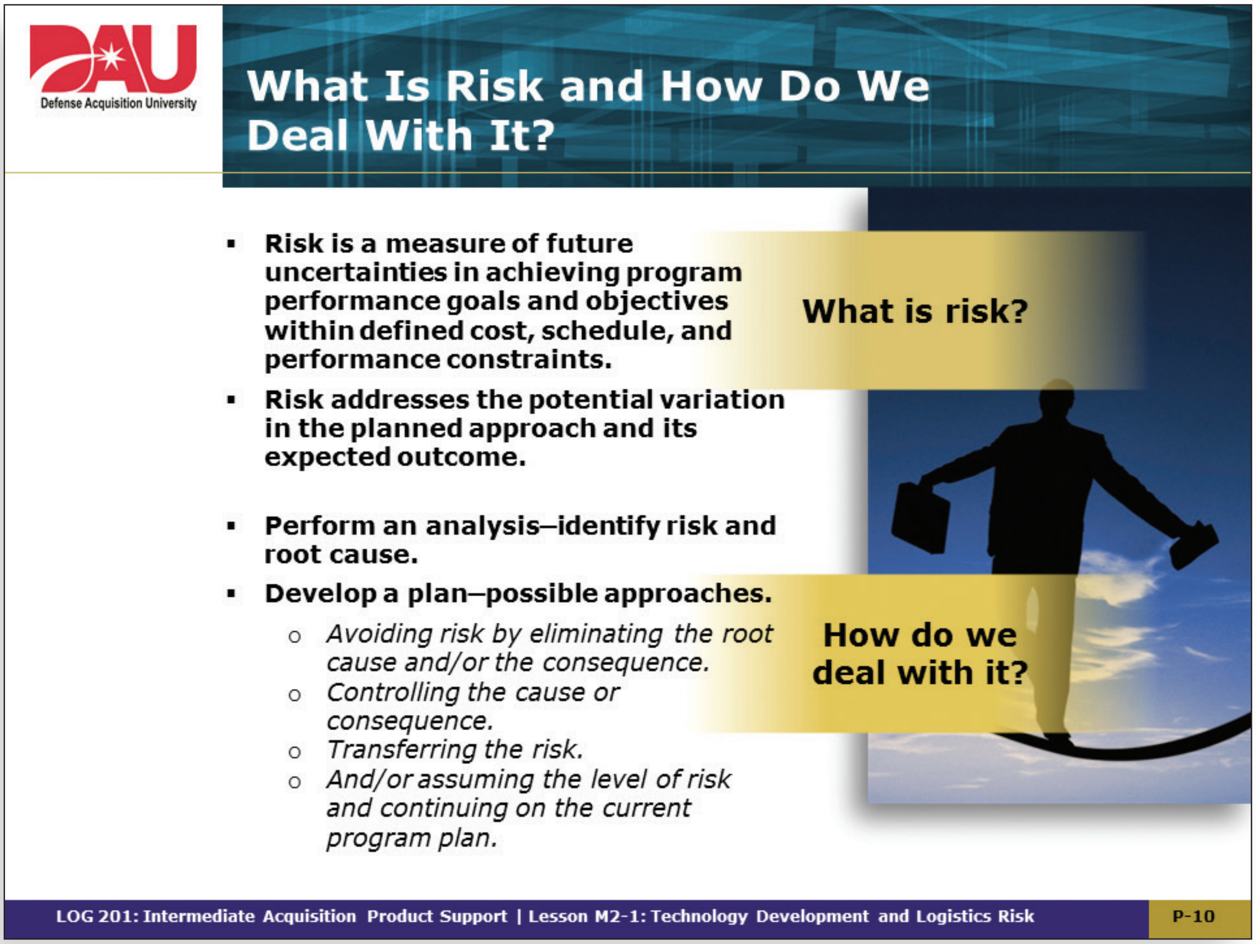
How do we determine the maturity of technology? Programs use the Technology Readiness Level.

Who determines the TRL of a system, subsystem, or component?

Who verifies the TRL is as stated?

Why do we want mature technologies?

TRL Level	Definition
1. Basic Principles Observed and Reported	Lowest level of technology readiness. Scientific research begins to be translated into applied research and development. Examples include paper studies of a technology's basic properties.
2. Technology Concept and/or Application Formulated	Invention begins. Once basic principles are observed, practical applications can be invented. The application is speculative, and there is no proof of detailed analysis to support the assumption. Examples are still limited to paper studies.
3. Analytical and Experimental Critical Function and/or Characteristic Proof of Concept	Active research and development is initiated. This includes analytical studies and laboratory studies to physically validate analytical predictions of separate elements of the technology.
4. Component and/or Breadboard Validation in Laboratory Environment	Basic technological components are integrated to establish that the pieces will work together. This is relatively "low-fidelity" compared to the eventual system. Examples include integration of "ad hoc" hardware in a laboratory.
5. Component and/or Breadboard Validation in Laboratory Environment	Fidelity of breadboard technology increases significantly. The basic technological components are integrated with reasonably realistic supporting elements so that the technology can be tested in a simulated environment. Examples include "high-fidelity" laboratory integration of components.
6. System/Subsystem Model or Prototype Demonstration in a Relevant Environment	Representative model or prototype system, which is well beyond the breadboard tested for TRL 5, is tested in a relevant environment. Represents a major step up in a technology's demonstrated readiness. Examples include testing a prototype in a high-fidelity laboratory environment or in simulated operational environment.
7. System Prototype Demonstration in an Operational Environment	Prototype near or at planned operational system. Represents a major step up from TRL 6, requiring the demonstration of an actual system prototype in an operational environment, such as in an aircraft, vehicle, or space. Examples include testing the prototype in a test bed aircraft.
8. Actual System Completed and "Flight Qualified" Through Test and Demonstration	Technology has been proven to work in its final form and under expected conditions. In almost all cases, this is the end of true system development. Examples include developmental test and evaluation of the system in its intended weapon system to determine if it meets design specifications.
9. Actual System "Flight Proven" through Successful Mission Operations	Actual application of the technology in its final form and under mission conditions such as those encountered in operational test and evaluation. In almost all cases, this is the end of the last "bug fixing" aspects of true system development. Examples include using the system under operational mission conditions.



Notes:

Two key aspects of risk

- Future Uncertainties
- How far from the plan will this take us?

How do we deal with risk?

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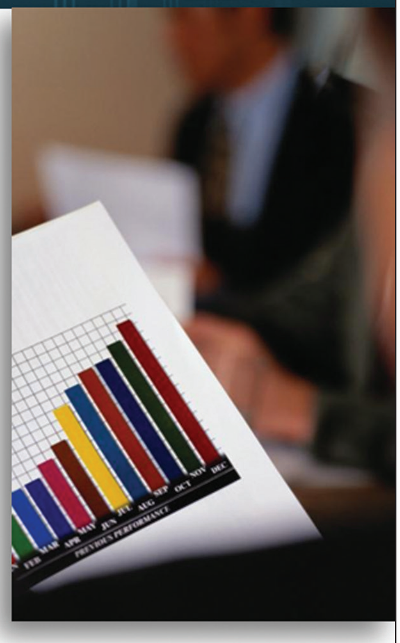
Is Market Research the Answer?

- **What is Market Research?**
- **How could this help with risk?**
- **The Federal Acquisition Streamlining Act of 1994 (FASA) requires that federal agencies to the extent possible:**
    - Buy commercial items, services, and nondevelopmental items.
    - At all levels to incorporate commercial and nondevelopmental items as components of systems they develop.
    - State specifications in terms that enable and encourage companies to supply commercial and nondevelopmental items.
- **What do we mean by commercial and nondevelopmental items?**



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Notes:

There are two components of Market Research:

- Market Surveillance
    - What is this?
    - Have you ever done Market Surveillance? Example?
- Market Investigation
    - What is this?
    - Have you ever done Market Investigation? Example?

How does this help with risk?

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How About Commercial-Off-The-Shelf (COTS)?

- **Is COTS the same as a commercial item?**
- **Do COTS items increase or decrease logistics risk?**
- **Let's look at a specific Strike Talon example.**
    - One of the derived requirements was that Strike Talon would have a Prognostics and Health Management System (PHMS).
    - What is a PHMS?
    - We've been given a list of COTS components with some data.
    - How do we evaluate?

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Notes:

What are the advantages of using a COTS product?

What are some of the disadvantages?

Does this introduce or reduce risk? How?

(Student Exercise [See Exercise Section for instructions.)

Adding to the LCSP

- We must capture risk in Section 9 of the LCSP.
- We must also assess the IPS Elements and capture in Section 5.
- Let's discuss what we need to add to our LCSP.

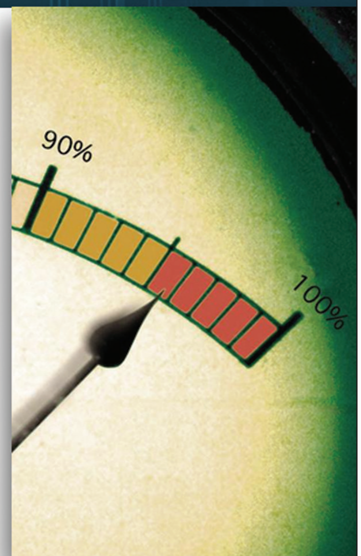

Table 9-2 Risk Summary

Risk	Rating	Driver	Mitigation Plan	Status

Table 5-2
Product Support Package Assessment

Product Support Element	Assessment	Discussion/Issues	Corrective Action/ECD
Product Support Management			OPR: (name)
Design Interface			OPR: (name)
Supply Support			OPR: (name)
Maintenance Planning and Management			OPR: (name)
PHS&T			OPR: (name)
Technical Data			OPR: (name)
Support Equipment			OPR: (name)
Training and Training Support			OPR: (name)
Manpower and Personnel			OPR: (name)
Facilities and Infrastructure			OPR: (name)
Computer Resources			OPR: (name)
Sustaining Engineering			OPR: (name)

LOG 201: Intermediate Acquisition Product Support | Lesson M2-1: Technology Development and Logistics Risk P-19

Technology Development Strategy: What's Next?

- **To minimize our logistics risk some of the technology needs maturing.**
- **Need to track progress during Tech Development.**
- **Need to answer some basic questions:**
  - What do you want to achieve?
  - How will you know when you get there?
  - How will you pay for it?
  - Who will execute it, and how?

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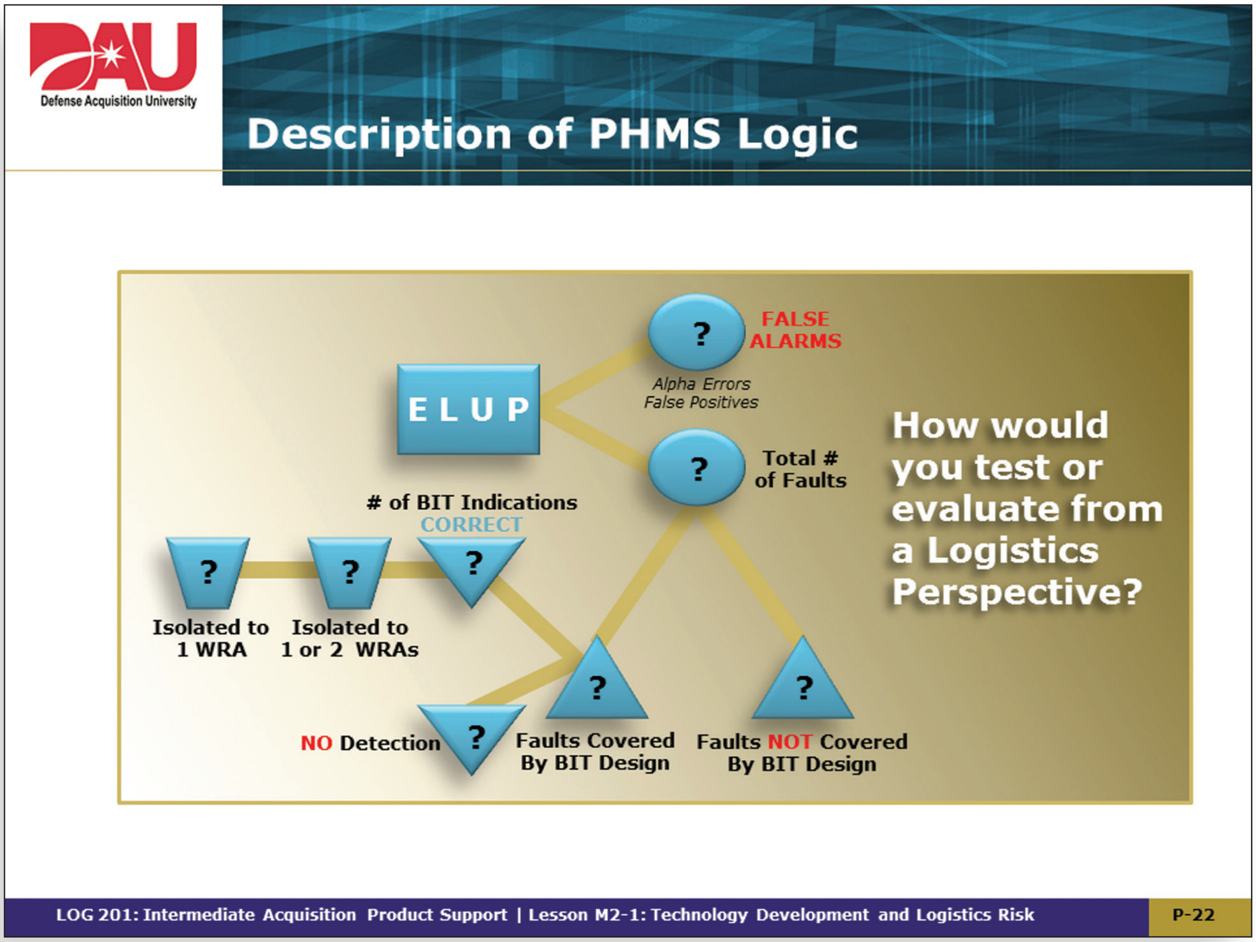

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Description of PHMS Logic
FALSE ALARMS
Alpha Errors
False Positives
ELUP
Total # of Faults
# of BIT Indications CORRECT
Isolated to 1 WRA
Isolated to 1 or 2 WRAs
NO Detection
Faults Covered By BIT Design
Faults NOT Covered By BIT Design
How would you test or evaluate from a Logistics Perspective?
LOG 201: Intermediate Acquisition Product Support | Lesson M2-1: Technology Development and Logistics Risk
P-22

Notes:

Developmental Test and Evaluation (DT&E)

Some basic definitions:

TEST

- A program, procedure, or process to obtain, verify, or provide data for determining the degree to which a system (component) meets, exceeds, or fails to meet its stated objectives.

EVALUATION

- The review, analysis, and assessment of data obtained from testing or other sources (to determine the degree).

TEST AND EVALUATION

- Process by which a system or components are compared against requirements and specifications through testing. The results are evaluated to assess progress of design, performance, supportability, etc.

Notes:

During the Technology Development Phase, in order for the maturing technology to be evaluated, testing must occur.

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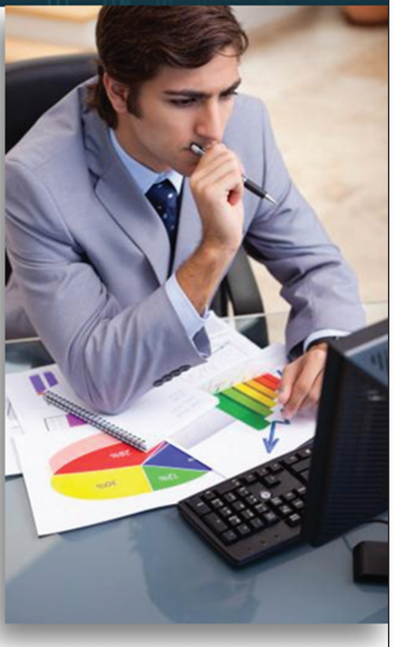
Testing—Why Do I Care?

- **Data, Data, Data**
- **Results from testing can have profound impacts on life-cycle cost estimates—particularly O&S cost estimates.**
- **You will probably be asked to make inputs to the TEMP for product support-related testing.**
- **Significant sustainment problems have resulted from incorporation of immature technology into weapon systems.**
  - Need to verify that technology (i.e., TRLs) is maturing IAW with your Technology Development Strategy.



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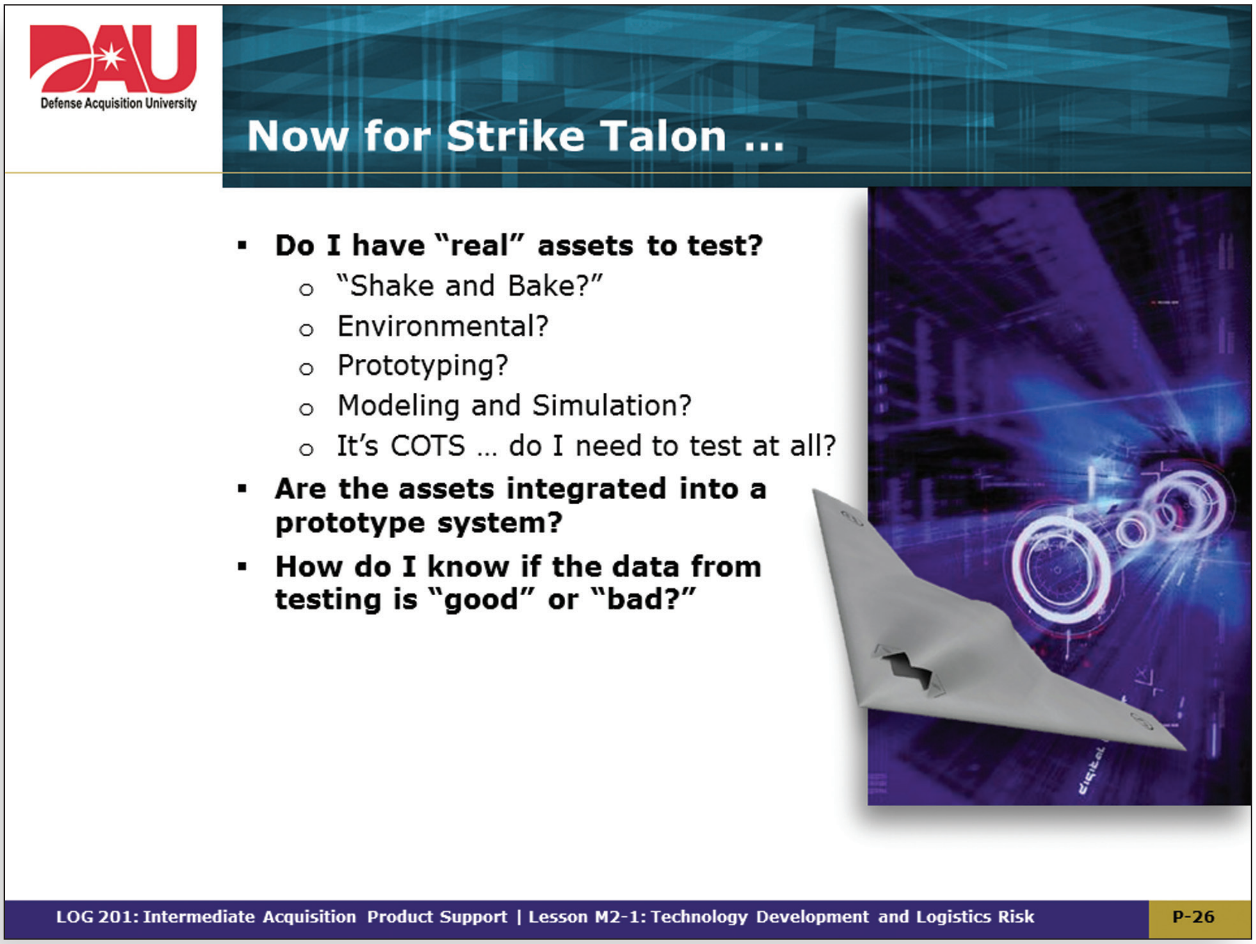
Notes:

In developing our Product Support Strategy we always want data. This helps us evaluate our choices and helps us to do the trade studies mentioned yesterday.



Notes:

Looking at the requirements for the different Technology Readiness Levels, what types of testing may be done the PHM components we've evaluated?

LCSP Table Updates

What else do we need to update in our LCSP?

- Let's review our previous input.
- What more do we now know?

LOG 201: Intermediate Acquisition Product Support | Lesson M2-1: Technology Development and Logistics Risk P-27

Life Cycle Sustainment Plan Outline

SECTIONS

1. **Introduction**
2. **Product Support Performance**
3. **Product Support Strategy**
4. Product Support Arrangements
5. **Product Support Package Status**
6. **Regulatory/Statutory Requirements That Influence Sustainment Performance**
7. **Integrated Schedule**
8. **Funding**
9. **Management**
10. **Supportability Analysis**
11. Additional Sustainment Planning Factors
12. LCSP Annexes

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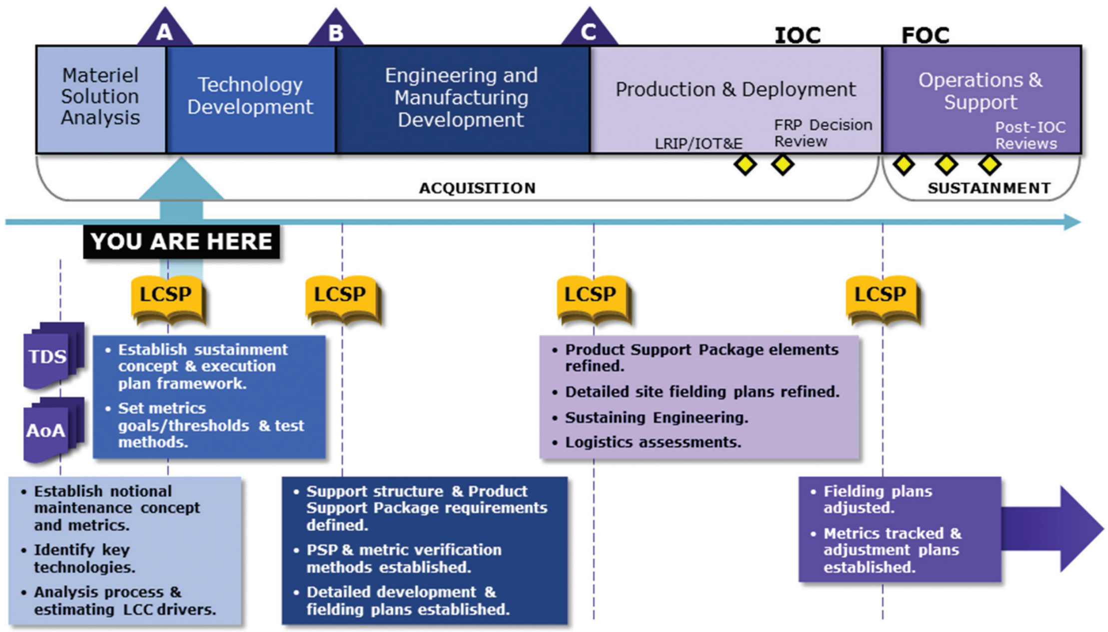
You Are Here ...



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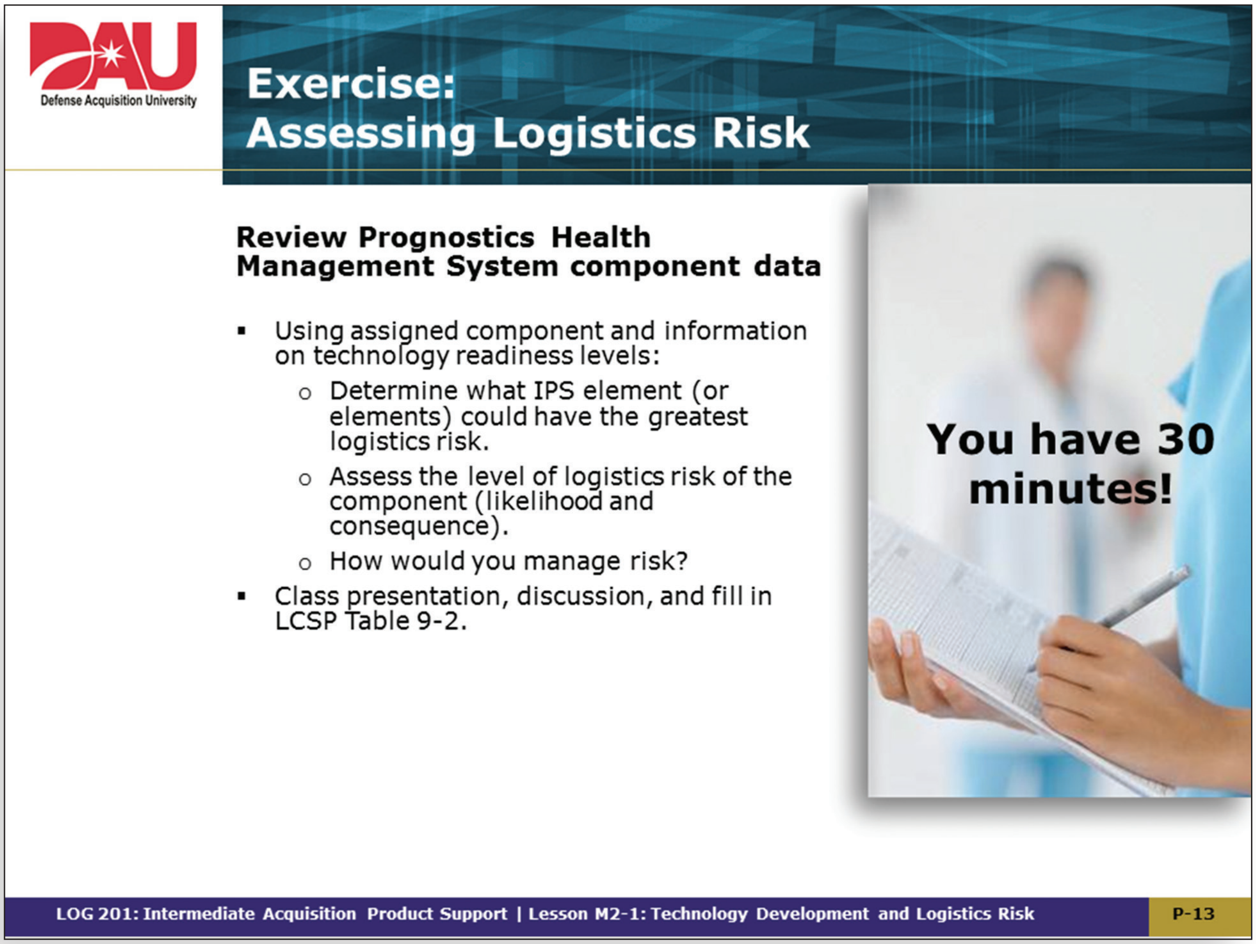
Summary

- You now understand there needs to be a strategy to mature technology
- You identified data needed to assess technological maturity
- You evaluated the logistics risk presented by immature technology and developed approaches to manage the logistics risk
- You updated the LCSP for the beginning of the Technology Development Phase to include Integrated Product Support elements and risk assessments

LOG 201: Intermediate Acquisition Product Support | Lesson M2-1: Technology Development and Logistics Risk | P-30

Lesson 2-1 Exercises



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Exercise Assignments

Teams	PHM Component
1	Engine Life Usage Processor
2	Corrosion
3	Flight Load
4	Radar Integrity
5	Carbon Stress

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You are assigned a specific component of the Strike Talon Prognostics Health Management System. For your assigned component, please refer to the additional information listed below. You also are provided a risk template to help you in this exercise. An electronic copy, like the one displayed in the slide deck, is available on your shared drive (see following pages).

Market Research and Component Data

As the lead life cycle logistician, you've done market research on the vendors and components for the Prognostics Health Management (PHM) System. In addition to the contractor data in the table below, you've found the following information regarding proposed components of the PHM System for the Strike Talon:

Table 1: Market Research Component Information

Component	Market Research and Contractor Data Findings
1. Engine Life Usage Processor	Many of the part numbers cross over to DoD cataloged materials. Of the recommended spares, 10 percent are coded as being retired/ obsolete. As of the cataloguing date, no replacement part numbers/stock numbers are listed.
2. Corrosion	Well-documented testing and support requirements. However, companies are very protective of proprietary information regarding this use and data collection processes for corrosion sensors
3. Flight Load	Initial data indicate the need for 40 percent of support equipment needed for evaluating sensors and components of the Flight Load component is peculiar to this system. No existing DoD assets are currently catalogued.
4. Radar Integrity	Software required to interpret data from the Radar Integrity component are proprietary and have not been tested/evaluated with existing DoD software.
5. Carbon Stress	Early development for sensors for this capability show promise in simulations. However, physical design is still being determined and sensor technology approach is being evaluated.

Component data for this exercise is in the table below.

Table 2: Contractor Component Data

Vendor →	Kildare			Slate			Spacely		
Monitoring Products	TRL	Perf.	Cost ($K)	TRL	Perf.	Cost ($K)	TRL	Perf.	Cost ($K)
Engine Life Usage	9	.85	$27	8	.73	$36	9	.91	$24
Oil Monitoring	7	.6	$16	8	.7	$21	8	.73	$36
Hydraulic Contamination	5	.53	$35	5	.64	$37	5	.72	$42
Corrosion	5	.33	$57	6	.46	$79	5	.45	$63
Flight Load	3	N/A	N/A	5	.67	$87	5	.71	$81
Radar Integrity	4	.37	$58	4	.5	$47	5	.61	$63
Flight Control	6	.65	$74	6	.62	$54	7	.77	$85
Carbon Stress	2	N/A	$5,000	1	N/A	N/A	2	.91	$3,500
Tire Condition	9	.95	$23	9	.94	$31	9	.90	$37
Flight Control Computer Integrity	5	.55	$76	4	.84	$49	3	N/A	N/A

TRL: Technology Readiness Level
Perf.: Performance. The ratio of detectable faults to observable faults the technology can detect with a high confidence level.
Cost ($K): The cost in $1,000's to add to each system.

Reading

Excerpt from *Risk Management Guide for DoD Acquisition,* Sixth Edition, August 2006.

1. Risk

Risk is a measure of future uncertainties in achieving program performance goals and objectives within defined cost, schedule, and performance constraints. Risk can be associated with all aspects of a program (e.g., threat, technology maturity, supplier capability, design maturation, performance against plan) as these aspects relate across the Work Breakdown Structure (WBS) and Integrated Master Schedule (IMS). Risk addresses the potential variation in the planned approach and its expected outcome. While such variation could include positive as well as negative effects, this guide will only address negative future effects since programs typically have experienced difficulty in this area during the acquisition process.

1.1. Components of Risk

Risks have three components:

- A future root cause (yet to happen), which, if eliminated or corrected, would prevent a potential consequence
- A probability (or likelihood) assessed at the present time of that future root cause occurring
- And the consequence (or effect) of that future occurrence

A future root cause is the most basic reason for the presence of a risk. Accordingly, risks should be tied to future root causes and their effects.

1.2. Risk vs. Issue Management

Risk management is the overarching process that encompasses identification, analysis, mitigation planning, mitigation plan implementation, and tracking. Risk management should begin at the earliest stages of program planning and continue throughout the program's total life cycle. Additionally, risk management is most effective if fully integrated with the program's systems engineering and program management processes—as a driver and a dependency on those processes for root cause and consequence management. A common misconception, and program office practice, concerning risk management is to identify and track issues (as opposed to risks), and then manage the consequences (rather than root causes). This practice tends to mask true risks, and it serves to track rather than resolve or mitigate risks. This guide focuses on risk mitigation planning and implementation rather than on risk avoidance, transfer, or assumption.

Note: Risks should not be confused with issues. If a root cause is described in the past tense, the root cause has already occurred, and, hence, is an issue that needs to be resolved, but not a risk. While issue management is one of the main functions of PMs, an important difference between issue management and risk management is that issue management applies resources to address and resolve current issues or problems while risk management applies resources to mitigate future potential root causes and their consequences.

To illustrate the difference between a risk and an issue, consider, for example, a commercial-off-the-shelf (COTS) sourcing decision process. Questions such as the following should be asked and answered prior to the COTS decision:

- "Is there any assurance the sole source provider of critical COTS components will not discontinue the product during government acquisition and usage?"
- "Does the government have a back-up source?"
- "Can the government acquire data to facilitate production of the critical components?"

These statements lead to the identification of root causes and possible mitigation plans. If a COTS acquisition is decided, and sometime later the manufacturer of a COTS circuit card has informed the XYZ radar builder that the circuit card will be discontinued and no longer available within 10 months, an issue has emerged that with upfront planning might have been prevented. A risk is the likelihood and consequence of future production schedule delays in radar deliveries if a replacement card cannot be found or developed and made available within 10 months.

If a program is behind schedule on release of engineering drawings to the fabricator, this is not a risk; it is an issue that already has emerged and needs to be resolved. Other examples of issues include failure of components under test or analyses that show a design shortfall. These are program problems that should be handled as issues instead of risks, since their probability is 1.0 (certain to occur or has occurred). It also should be noted that issues may have adverse future consequences to the program (as a risk would have).

1.3. Risk Management Objective

PMs have a wide range of supporting data and processes to help them integrate and balance programmatic constraints against risk. The Acquisition Program Baseline (APB) for each program defines the top-level cost, schedule, and technical performance parameters for that program. Additionally, acquisition planning documents such as Life-Cycle Cost Estimates (LCCE), Systems Engineering Plans (SEP), IMS, Integrated Master Plans (IMP), Test and Evaluation Master Plans (TEMP), and Technology Readiness Assessment (TRA) provide detailed cost, schedule, and technical performance measures for program management efforts. Since effective risk management requires a stable and recognized baseline from which to access, mitigate, and manage program risk, it is critical that the program use an IMP/IMS. Processes managed by the contractor, such as the IMP, contractor IMS, and Earned Value Management (EVM), provide the PM with additional insight into balancing program requirements and constraints against cost, schedule, or technical risk. The objective of a well-managed risk management program is to provide a repeatable process for balancing cost, schedule, and performance goals within program funding, especially on programs with designs that approach or exceed the state of the art or have tightly constrained or optimistic cost, schedule, and performance goals. Without effective risk management, the program office may find itself doing crisis management, a resource-intensive process typically constrained by a restricted set of available options. Successful risk management depends on the knowledge gleaned from assessments of all aspects of the program coupled with appropriate mitigations applied to the specific root causes and consequences.

A key concept here is that the government shares the risk with the development, production, or support contractor (if commercial support is chosen), and does not transfer all risks to the contractor. The program office always has a responsibility to the system user to develop a capable and supportable system and cannot absolve itself of that responsibility. Therefore, all program risks, whether primarily managed by the program office or by the development/support contractor, are of concern and must be assessed and managed by the program office. Once the program office has determined which risks and how much of each risk to share with the contractor, it must then assess the total risk assumed by the developing contractor (including subcontractors). The program office and the developer must work from a common risk management process and database. Successful mitigation requires that government and the contractor communicate all program risks for mutual adjudication. Both parties may not always agree on risk likelihoods, and the government PM maintains ultimate approval authority for risk definition and assignment. A common risk database available and open to the government and the contractor is an extremely valuable tool. Risk mitigation involves selection of the option that best provides the balance between performance and cost. Remember that schedule slips generally and directly impact cost. It also is possible that throughout the system life cycle there may be a need for different near-term and long-term mitigation approaches.

To succeed, an effective risk management process requires a commitment on the part of the PM, the program office, and the contractor. There are many impediments to risk management implementation. However, the program team must work together to overcome these obstacles. One good example is the natural reluctance to identify real program risks early for fear of jeopardizing support of the program by decision makers. Another example is the lack of sufficient funds to properly implement the risk mitigation process. However, when properly resourced and implemented, the risk management process supports setting and achieving realistic cost, schedule, and performance objectives and provides early identification of risks for special attention and mitigation.

2. Risk Management

2.1 The Risk Management Process

Risk management is a continuous process that is accomplished throughout the life cycle of a system. It is an organized methodology for continuously identifying and measuring the unknowns; developing mitigation options; selecting, planning, and implementing appropriate risk mitigations; and tracking the implementation to ensure successful risk reduction. Effective risk management depends on risk management planning; early identification and analyses of risks; early implementation of corrective actions; continuous monitoring and reassessment; and communication, documentation, and coordination.

Acquisition program risk management is not a stand-alone program office task. It is supported by a number of other program office tasks. In turn, the results of risk management are used to finalize those tasks. Important tasks, which must be integrated as part of the risk management process, include requirements development, logical solution, and design solution (systems engineering), schedule development, performance measurement, EVM (when implemented), and cost estimating. Planning a good risk management program integral to the overall program management process ensures risks are handled at the appropriate management level.

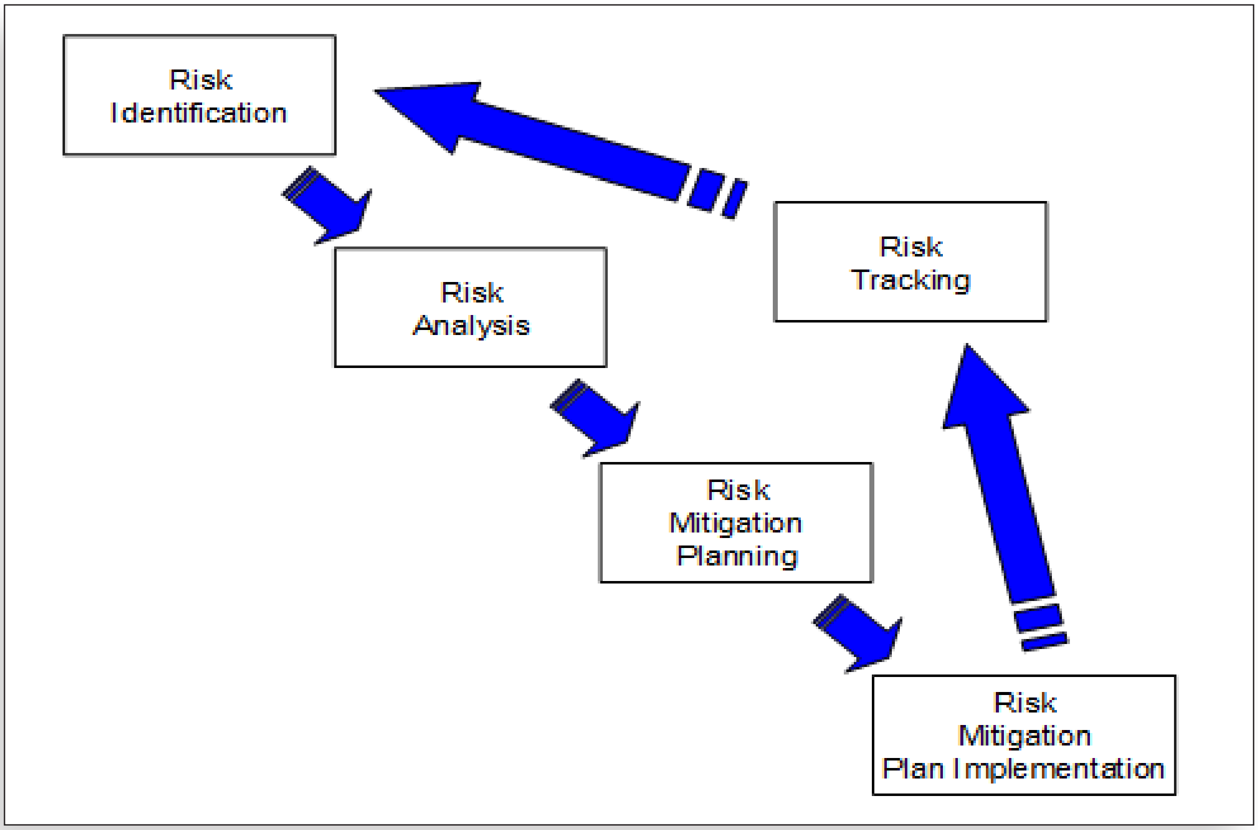
Emphasis on risk management coincides with overall DoD efforts to reduce life-cycle costs (LCCs) of system acquisitions. New processes, reforms, and initiatives are implemented with risk management as a key component. It is essential that programs define, implement, and document an appropriate risk management and mitigation approach. Risk management should be designed to enhance program management effectiveness and provide PMs with a key tool to reduce LCCs, increase program likelihood of success, and assess areas of cost uncertainty.

2.2 The Risk Management Process Model

The risk management process model (see Figure 1) includes the following key activities, performed on a continuous basis:

- Risk Identification
- Risk Analysis
- Risk Mitigation Planning
- Risk Mitigation Plan Implementation
- Risk Tracking

Figure 1. DoD Risk Management Process



Acquisition programs run the gamut from simple to complex procurements and support of mature technologies that are relatively inexpensive to state-of-the-art-and-beyond programs valued in the many billions of dollars. Effective risk management approaches generally have consistent characteristics and follow common guidelines regardless of program size. Some characteristics of effective risk management approach are discussed below.

2.3 Characteristics of Successful Risk Management Approaches

Successful acquisition programs likely will have the following risk management characteristics:

- Feasible, stable, and well-understood user requirements, supported by leadership/stakeholders, and integrated with program decisions
- A close partnership with users, industry, and other stakeholders
- A planned risk management process integral to the acquisition process, especially to the technical planning (SEP and TEMP) processes, and other program-related partnerships
- Continuous, event-driven technical reviews to help define a program that satisfies the user's needs within acceptable risk
- Identified risks and completed risk analyses
- Developed, resourced, and implemented risk mitigation plans
- Acquisition and support strategies consistent with risk level and risk mitigation plans
- Established thresholds and criteria for proactively implementing defined risk mitigation plans
- Continuous and iterative assessment of risks
- The risk analysis function independent from the PM
- A defined set of success criteria for performance, schedule, and cost elements
- A formally documented risk management process

To support these efforts, assessments via technical reviews should be performed as early as possible in the life cycle (as soon as performance requirements are developed) to ensure critical performance, schedule, and life-cycle cost risks are addressed, with mitigation actions incorporated into program planning and budget projections. As the award of a contract requiring EVM approaches, preparation and planning should commence for the execution of the Integrated Baseline Review (IBR) process in accordance with the *Defense Acquisition Guidebook*.

Lesson 2-2

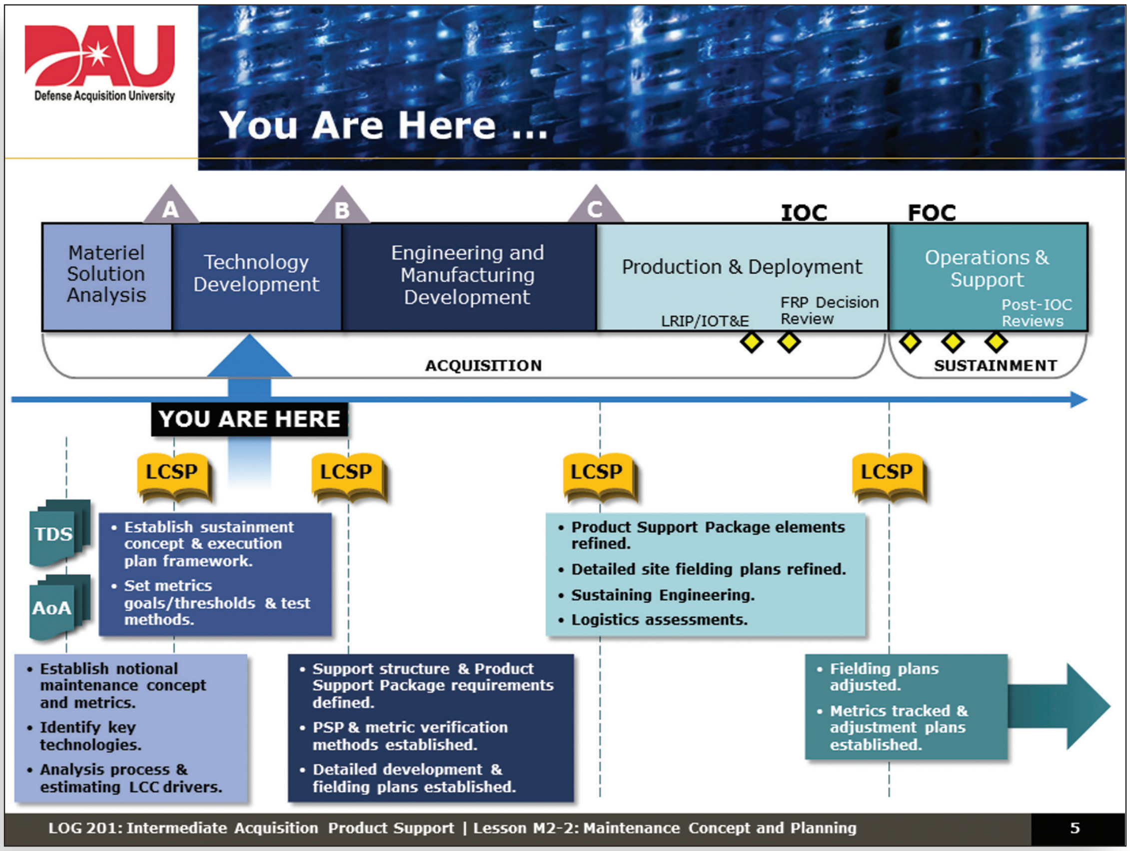
Maintenance Concept and Planning

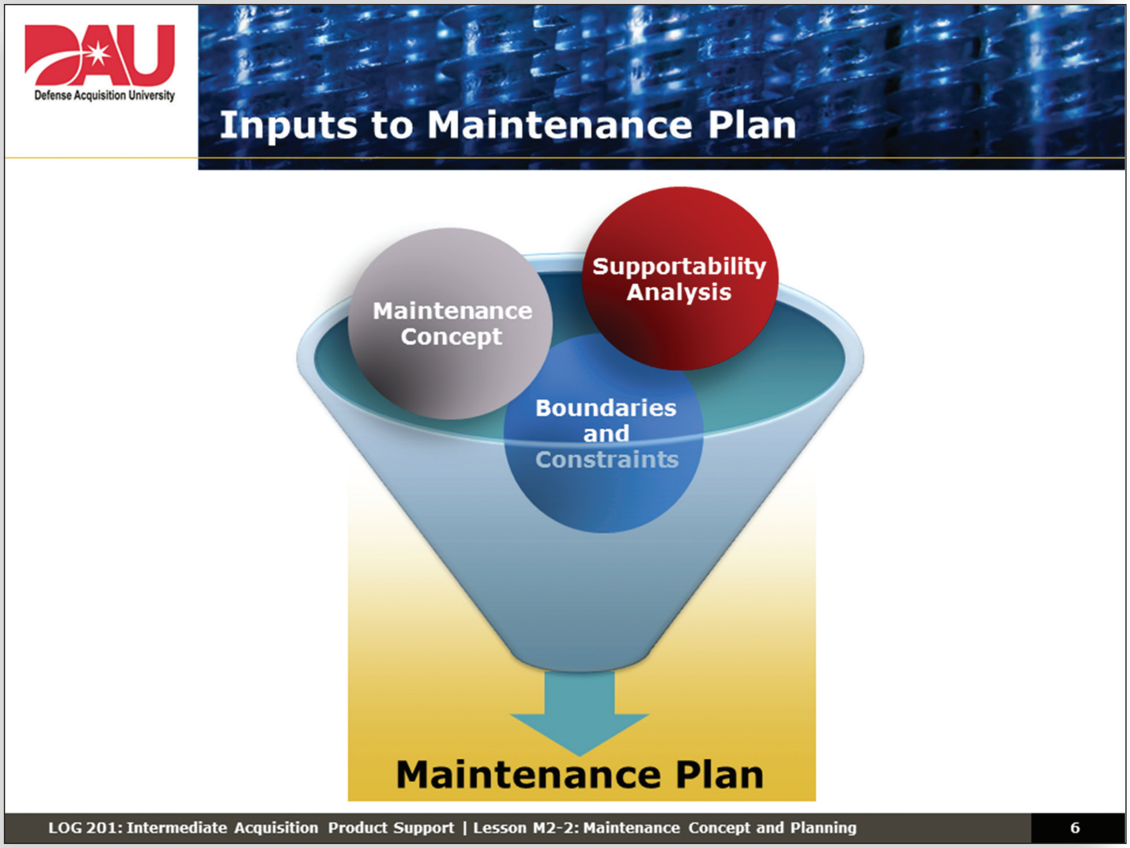
Lesson Objectives:

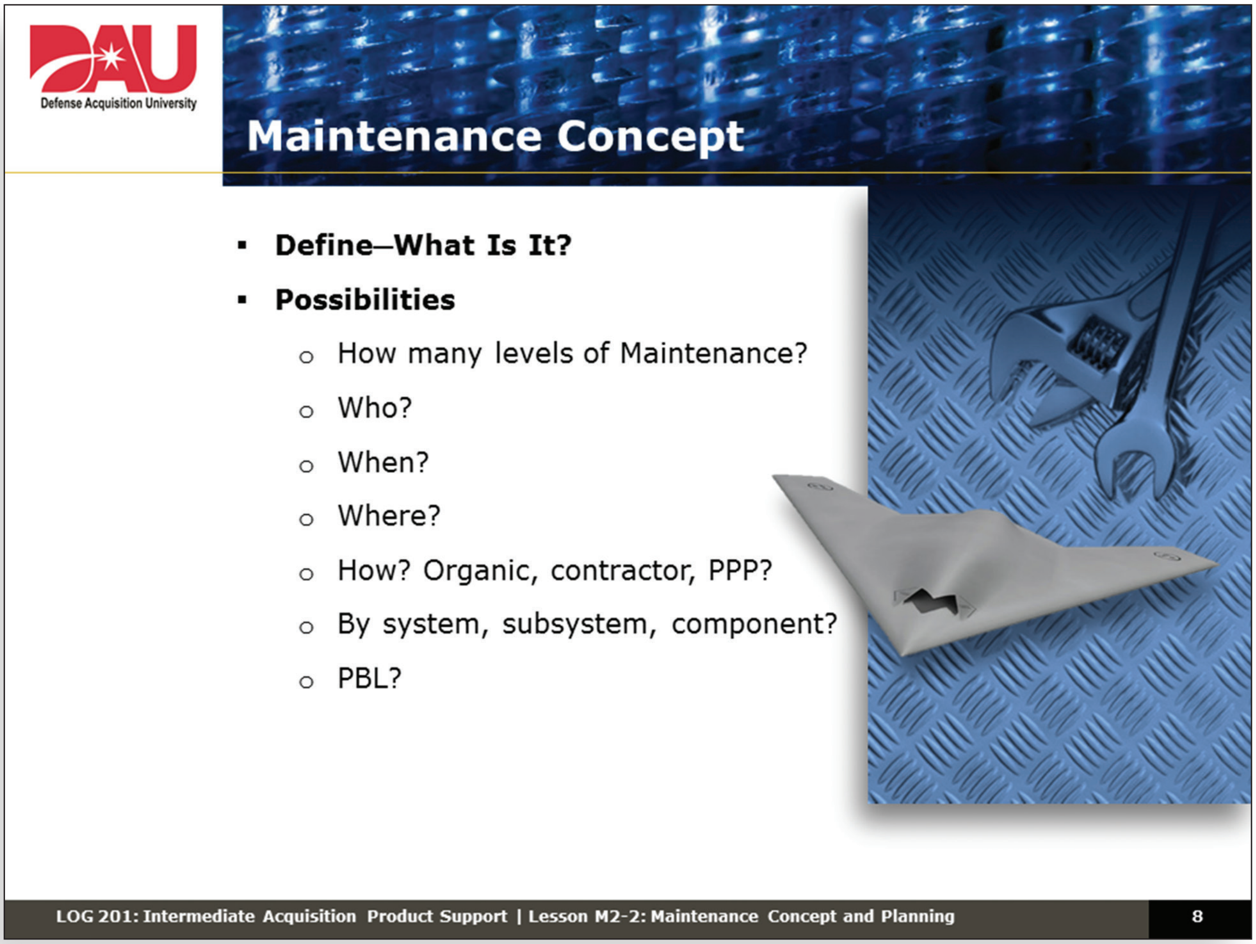
- Given class materials, policy, and framework documents, define Maintenance Concept.
- Given program, policy, and framework documents, determine the Strike Talon Maintenance Concept.
- Given information on supportability analysis, program, policy, and framework documents, and the Strike Talon Maintenance Concept summarize a Maintenance Plan.
- Given a Maintenance Plan and the IPS Elements, evaluate and update the Product Support Strategy and Life Cycle Sustainment Plan.

What's In It for Me?

- You will understand what is included in a maintenance concept.
- You will identify the Strike Talon maintenance concept(s).
- You will understand the basic concepts of supportability analysis.
- You will understand how to use the maintenance concept, supportability analysis, and constraints/boundaries to formulate a maintenance plan.
- You will evaluate the maintenance plan against the IPS Elements.
- You will update the LCSP with information from the maintenance plan evaluation/assessment.


You Are Here ...
Defense Acquisition University
A
B
C
IOC
FOC
Materiel Solution Analysis
Technology Development
Engineering and Manufacturing Development
Production & Deployment
FRP Decision Review
LRIP/IOT&E
Operations & Support
Post-IOC Reviews
ACQUISITION
SUSTAINMENT
YOU ARE HERE
LCSP
LCSP
LCSP
LCSP
TDS
AoA
• Establish sustainment concept & execution plan framework.
• Set metrics goals/thresholds & test methods.
• Product Support Package elements refined.
• Detailed site fielding plans refined.
• Sustaining Engineering.
• Logistics assessments.
• Establish notional maintenance concept and metrics.
• Identify key technologies.
• Analysis process & estimating LCC drivers.
• Support structure & Product Support Package requirements defined.
• PSP & metric verification methods established.
• Detailed development & fielding plans established.
• Fielding plans adjusted.
• Metrics tracked & adjustment plans established.
LOG 201: Intermediate Acquisition Product Support | Lesson M2-2: Maintenance Concept and Planning
5

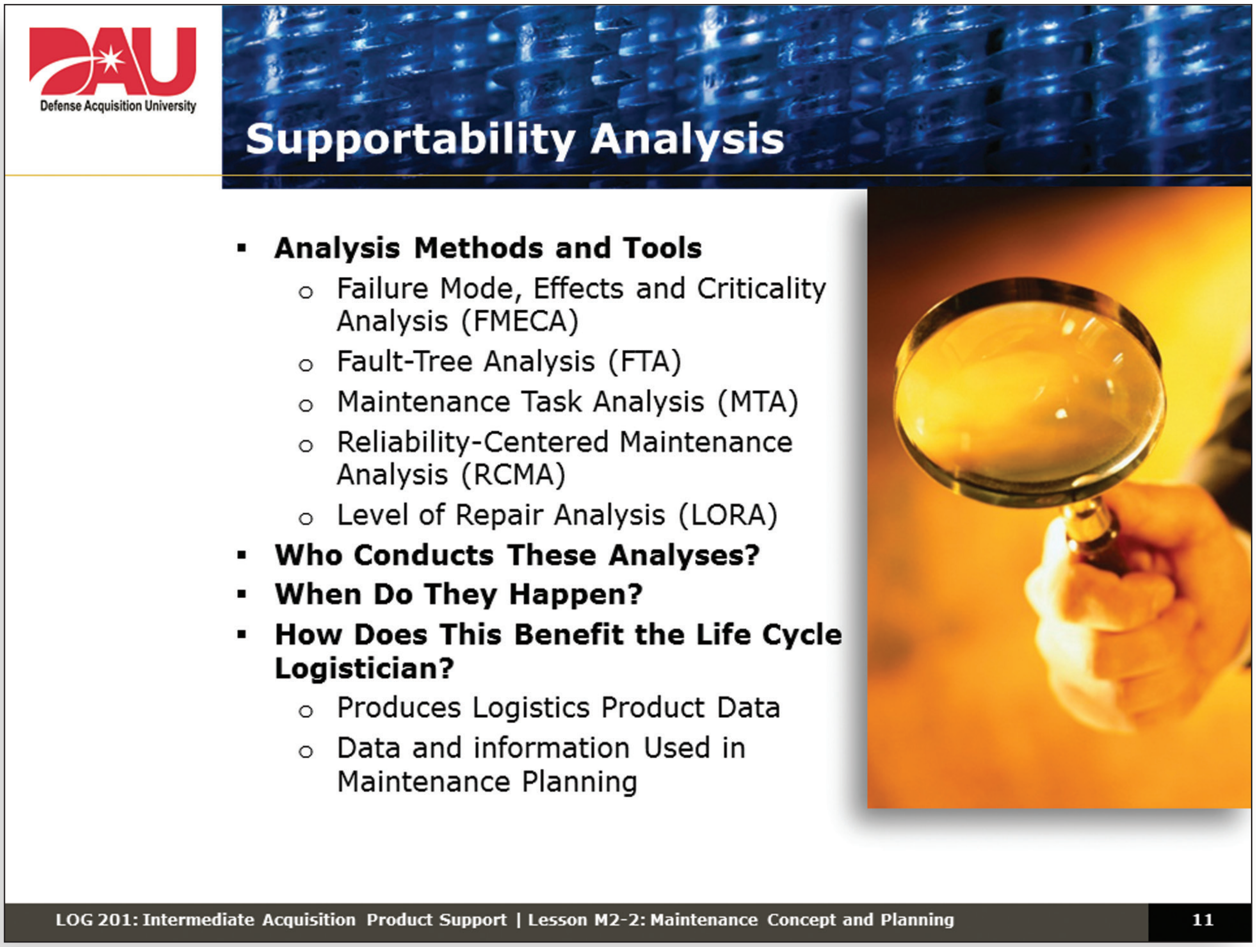

Inputs to Maintenance Plan
Defense Acquisition University
Maintenance Concept
Supportability Analysis
Boundaries and Constraints
Maintenance Plan
LOG 201: Intermediate Acquisition Product Support | Lesson M2-2: Maintenance Concept and Planning
6



Notes:

- Define—what is it?
- Possibilities
  - How many levels of Maintenance?
  - Who?
  - When?
  - Where?
  - How? Organic, contractor, PPP?
  - By system, subsystem, component?
  - Performance-Based Life Cycle Support?

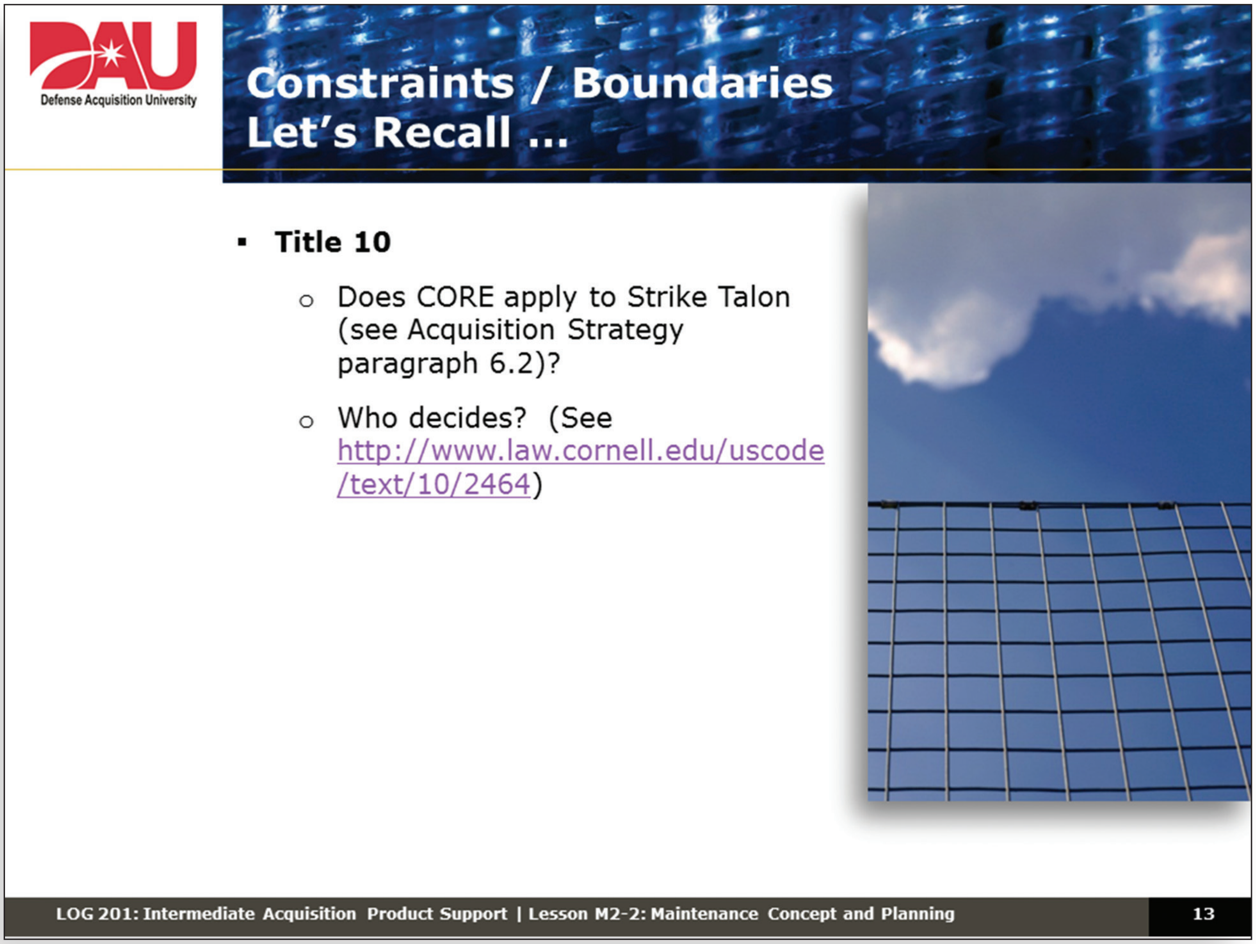
Student Exercise 1 (see Exercise Section for instructions)



Notes:

What is Supportability Analysis?

- FMECA
- FTA
- MTA
- RCMA
- LORA


Defense Acquisition University
Constraints / Boundaries
Let's Recall ...
Title 10
Does CORE apply to Strike Talon (see Acquisition Strategy paragraph 6.2)?
Who decides? (See http://www.law.cornell.edu/uscode/text/10/2464)
LOG 201: Intermediate Acquisition Product Support | Lesson M2-2: Maintenance Concept and Planning
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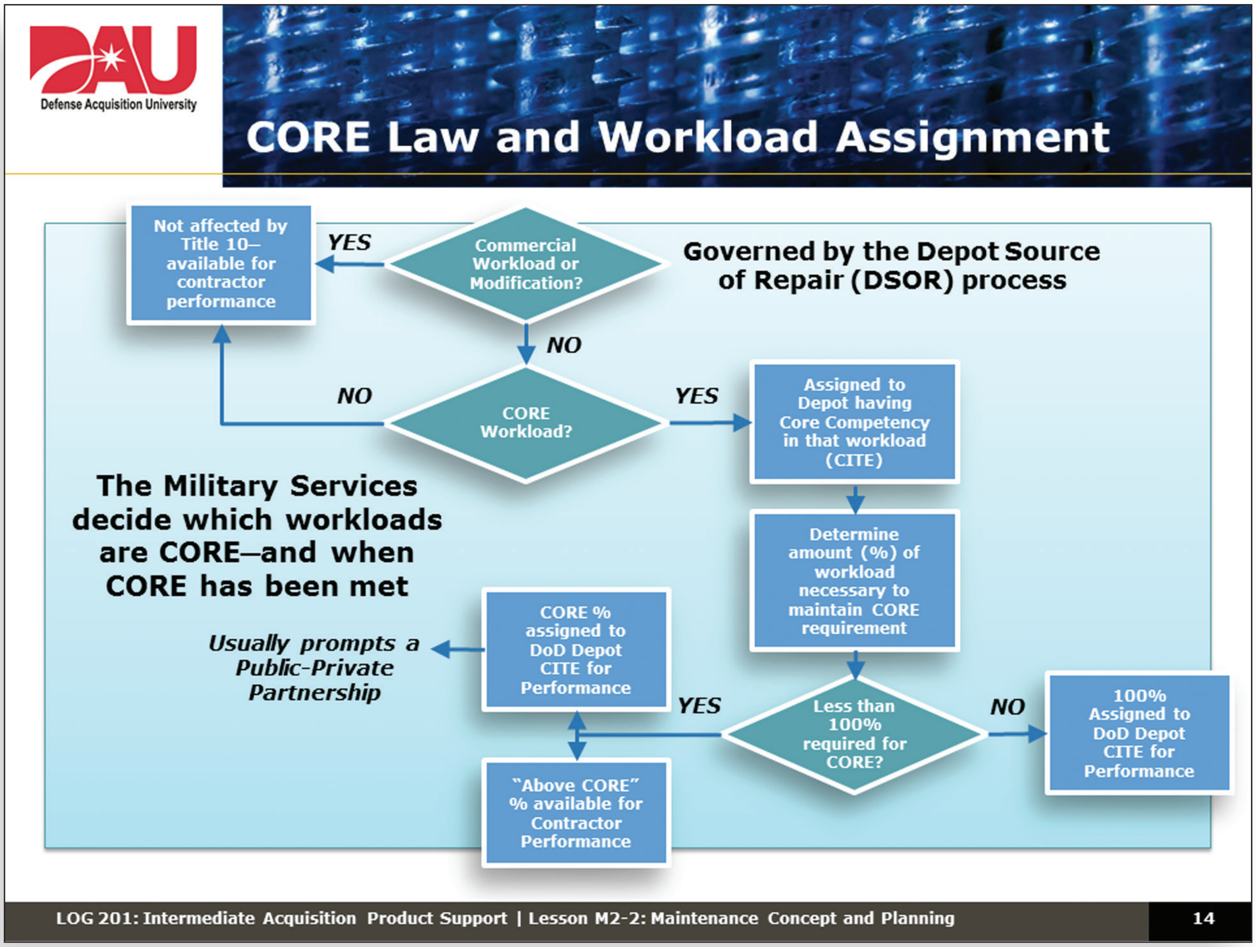
Notes: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CORE Law and Workload Assignment
Not affected by Title 10– available for contractor performance
YES
Commercial Workload or Modification?
Governed by the Depot Source of Repair (DSOR) process
NO
NO
CORE Workload?
YES
Assigned to Depot having Core Competency in that workload (CITE)
The Military Services decide which workloads are CORE–and when CORE has been met
Determine amount (%) of workload necessary to maintain CORE requirement
CORE % assigned to DoD Depot CITE for Performance
Usually prompts a Public-Private Partnership
YES
Less than 100% required for CORE?
NO
100% Assigned to DoD Depot CITE for Performance
"Above CORE" % available for Contractor Performance
LOG 201: Intermediate Acquisition Product Support | Lesson M2-2: Maintenance Concept and Planning
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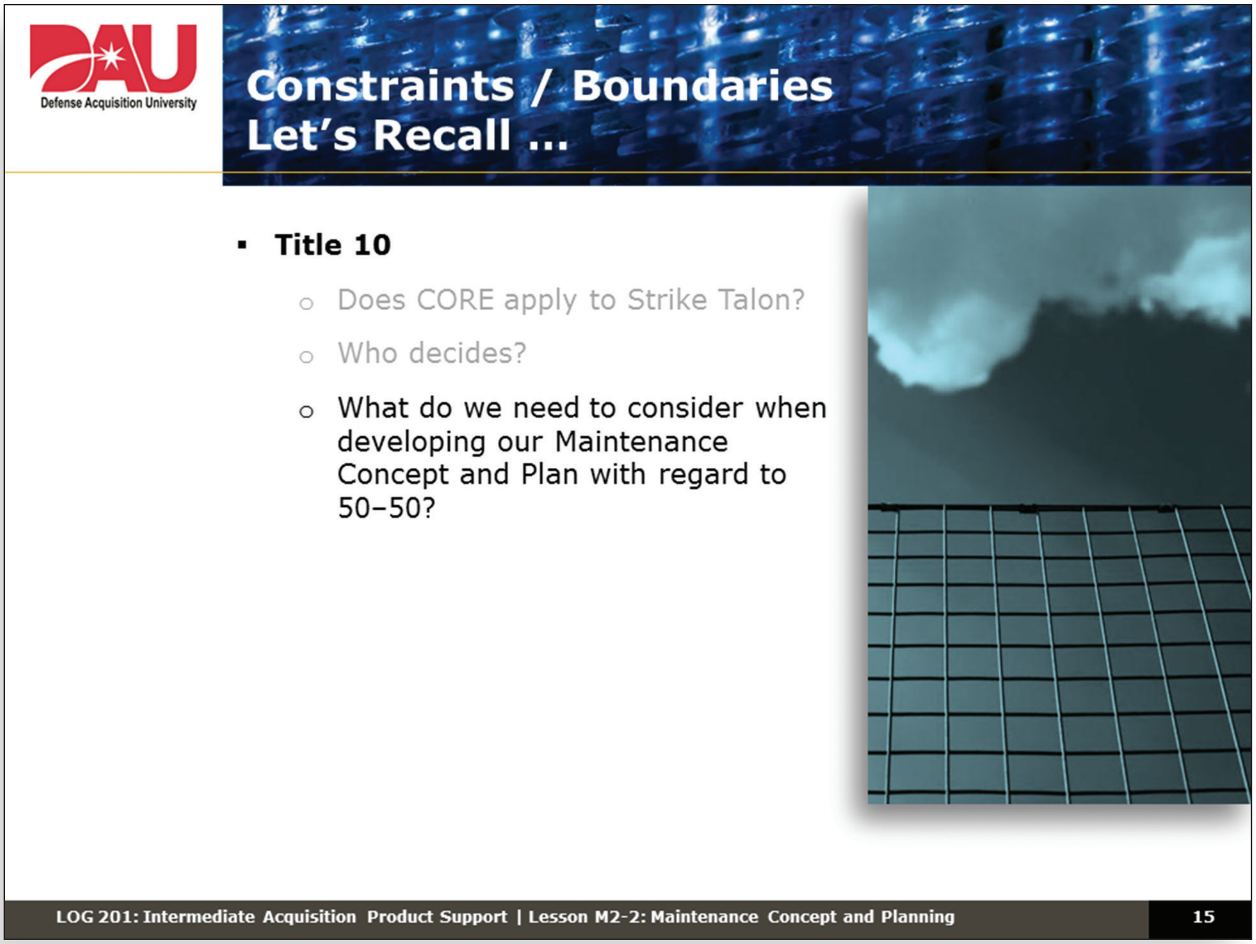
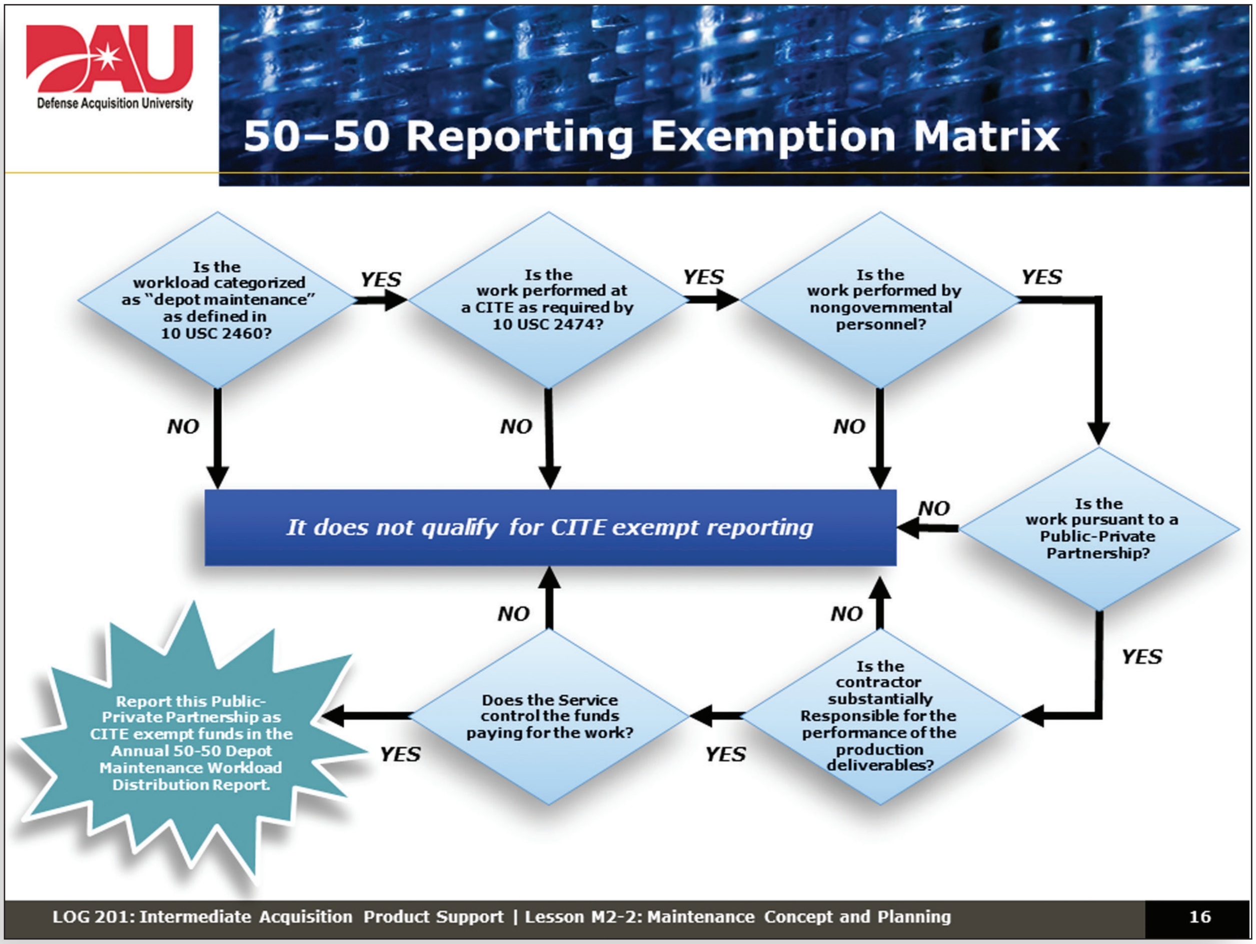
Notes:


Defense Acquisition University
Constraints / Boundaries
Let's Recall ...
▪ Title 10
o Does CORE apply to Strike Talon?
o Who decides?
o What do we need to consider when developing our Maintenance Concept and Plan with regard to 50–50?
LOG 201: Intermediate Acquisition Product Support | Lesson M2-2: Maintenance Concept and Planning
15

Notes:



Defense Acquisition University
50–50 Reporting Exemption Matrix
Is the workload categorized as "depot maintenance" as defined in 10 USC 2460?
YES
Is the work performed at a CITE as required by 10 USC 2474?
YES
Is the work performed by nongovernmental personnel?
YES
NO
NO
NO
It does not qualify for CITE exempt reporting
NO
Is the work pursuant to a Public-Private Partnership?
YES
NO
NO
Report this Public-Private Partnership as CITE exempt funds in the Annual 50-50 Depot Maintenance Workload Distribution Report.
YES
Does the Service control the funds paying for the work?
YES
Is the contractor substantially Responsible for the performance of the production deliverables?
LOG 201: Intermediate Acquisition Product Support | Lesson M2-2: Maintenance Concept and Planning
16

Notes:

Constraints / Boundaries
Let's Recall …

- **Title 10**
  - Does CORE apply to Strike Talon?
  - Who decides?
  - What do we need to consider when developing our Maintenance Concept and Plan with regard to 50–50?
- **What is our final (class) Maintenance Concept?**
- **Remember what we said about the effect on Integrated Product Support Elements and the LCSP.**

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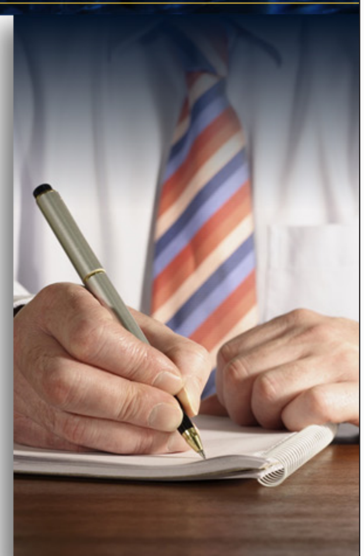
Updating Our LCSP

We need to update our LCSP

- We've had an Independent Logistics Assessment
- We've discussed the Product Support Strategy
- What significant changes do we need to make to our LCSP?
- What about risk?
- Any other updates?

Pull up the Milestone B LCSP



LOG 201: Intermediate Acquisition Product Support | Lesson M2-2: Maintenance Concept and Planning 18

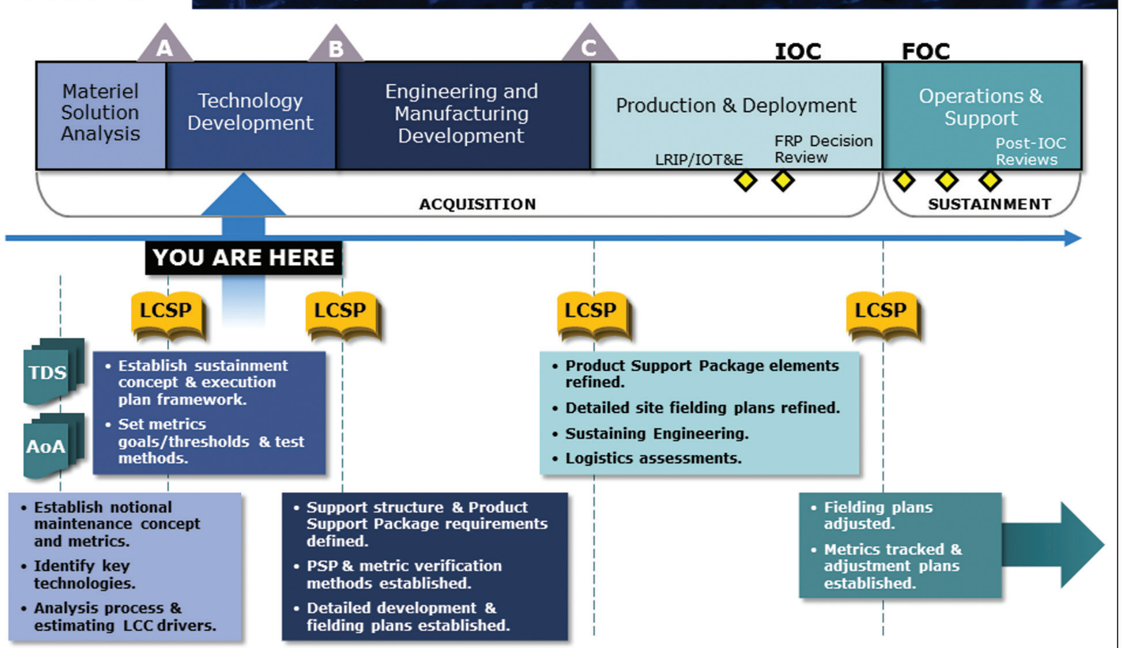
LCSP – Anything Else We Need to Update?

SECTIONS

1. Introduction
2. Product Support Performance
3. Product Support Strategy
4. Product Support Arrangements
5. Product Support Package Status
6. Regulatory/Statutory Requirements That Influence Sustainment Performance
7. Integrated Schedule
8. Funding
9. Management
10. Supportability Analysis
11. Additional Sustainment Planning Factors
12. LCSP Annexes

LOG 201: Intermediate Acquisition Product Support | Lesson M2-2: Maintenance Concept and Planning 23

You Are Here …



LOG 201: Intermediate Acquisition Product Support | Lesson M2-2: Maintenance Concept and Planning 5

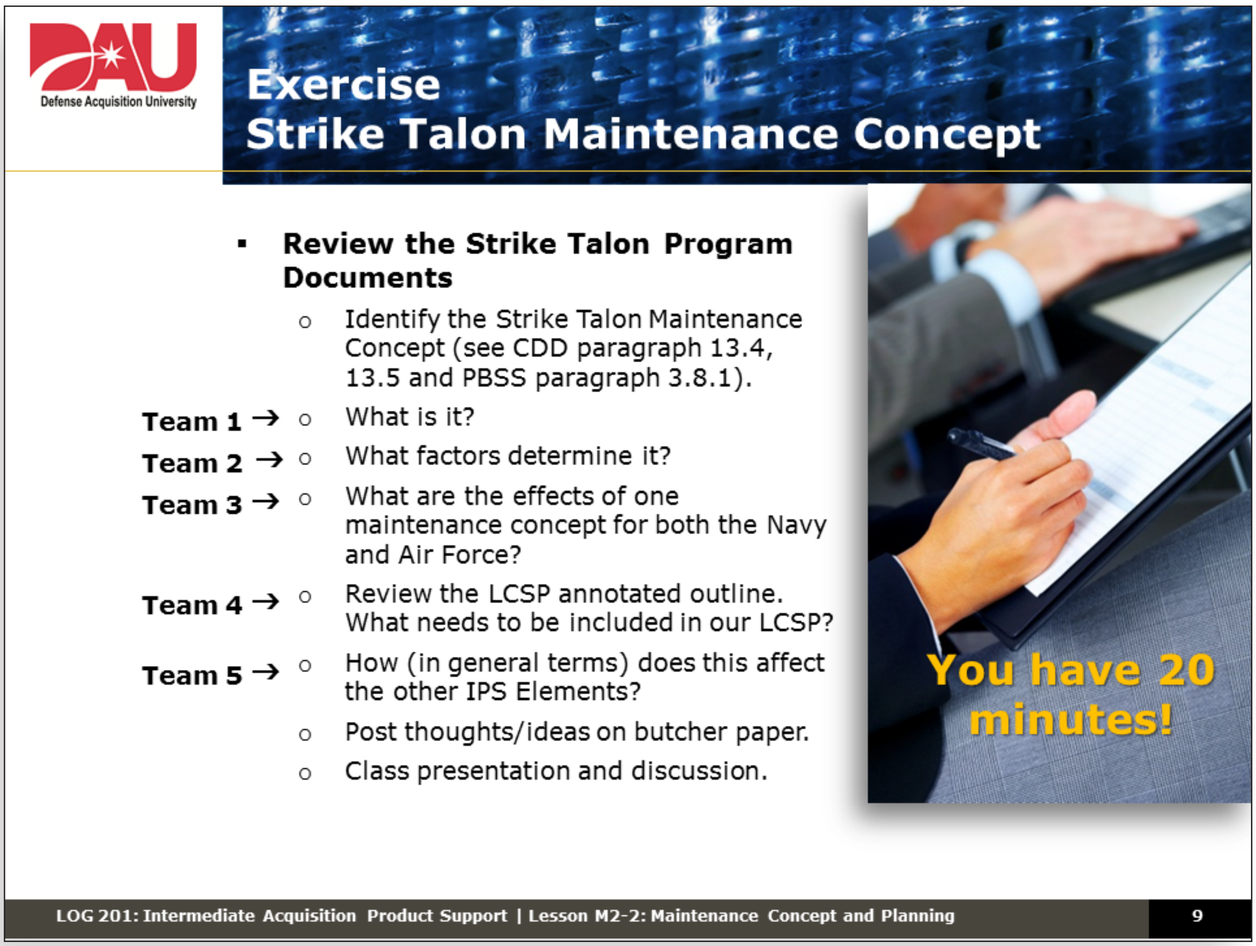
Summary

- You now understand what is included in a maintenance concept.
- You identified the Strike Talon maintenance concept(s).
- You understand the basic concepts of supportability analysis.
- You understand how to use the maintenance concept, supportability analysis, and constraints/boundaries to formulate a maintenance plan.
- You evaluated the maintenance plan against the IPS Elements.
- You updated the LCSP with information from the maintenance plan evaluation/assessment.

LOG 201: Intermediate Acquisition Product Support | Lesson M2-2: Maintenance Concept and Planning | 24

Notes:

Lesson 2-2 Exercise



Reading

Supportability Analysis Student Reading

MIL-HDBK-502, Acquisition Logistics, defines supportability analysis as "a wide range of analyses that should be conducted within the systems engineering process. The goals of supportability analyses are to ensure that supportability is included as a system performance requirement and to ensure the system is concurrently developed or acquired with the optimal support system and infrastructure."

While many systems are developed in a "joint" environment, Service-specific policies related to product support will shape the parameters in many aspects of supportability analysis. One such policy that profoundly impacts supportability analyses is maintenance levels of repair. The Air Force espouses a two-level repair process while the Navy, for the most part, utilizes three levels of repair. Other examples might include Service policies related to Condition-Based Maintenance, Prognostics and Health Management, use of contractors on the battlefield, sparing models and supply support requirements, facilities-usage, manpower loading, human systems integration, Environment, Safety and Occupational Health (ESOH), to name a few. While it's not the intent of this module to teach each Service's unique policies, the systems engineer and life-cycle logistician (LCL) must be aware of the boundaries, constraints, or parameters resulting from those policies.

In the earlier definition, supportability analysis is defined as a "systems engineering process." This does *not* exclude the LCL's involvement in all phases of supportability analysis. In some cases, it will be by taking an active role in the conduct of various analyses and at other times carefully monitoring the results.

An LCL has two goals as part of an acquisition team:

1. Reduce the demand for logistics.
2. Provide required logistics efficiently and effectively.

The LCL's involvement in a robust supportability analysis program will ensure both goals are met.

One question often asked by the LCL is the relationship between supportability analysis and acquisition logistics. First, the purpose of acquisition logistics:

> *"Acquisition logistics ensures the system is designed for supportability, and the support elements are acquired and provided to the customer."*

(DAU Acquisition Community Connection (ACC) Practice Center, Life Cycle Logistics, Acquisition Logistics ***(https://acc.dau.mil/CommunityBrowser.aspx?id=141852)***)

Second, the purpose of supportability analysis:

> *"Supportability analysis is to ensure the system is designed for supportability, and the support elements are acquired and provided to the customer."*

(*Defense Acquisition Guidebook*, 5.4.2.2.1. Initial Life-Cycle Sustainment Plan, ***(https://acc.dau.mil/CommunityBrowser.aspx?id=328735)***)

It's obvious that the definitions are identical. The difference lies not in the purpose of the two but under whose purview they are conducted. Supportability analysis is conducted under the purview of the system engineering process while the LCL conducts acquisition logistics. You would be correct in assuming that supportability analysis and acquisition logistics are different sides of the same coin.

Supportability analysis includes the integration of various analytical techniques with the objective of designing and developing an effective and efficient logistics support infrastructure. The primary techniques used in supportability analysis are:

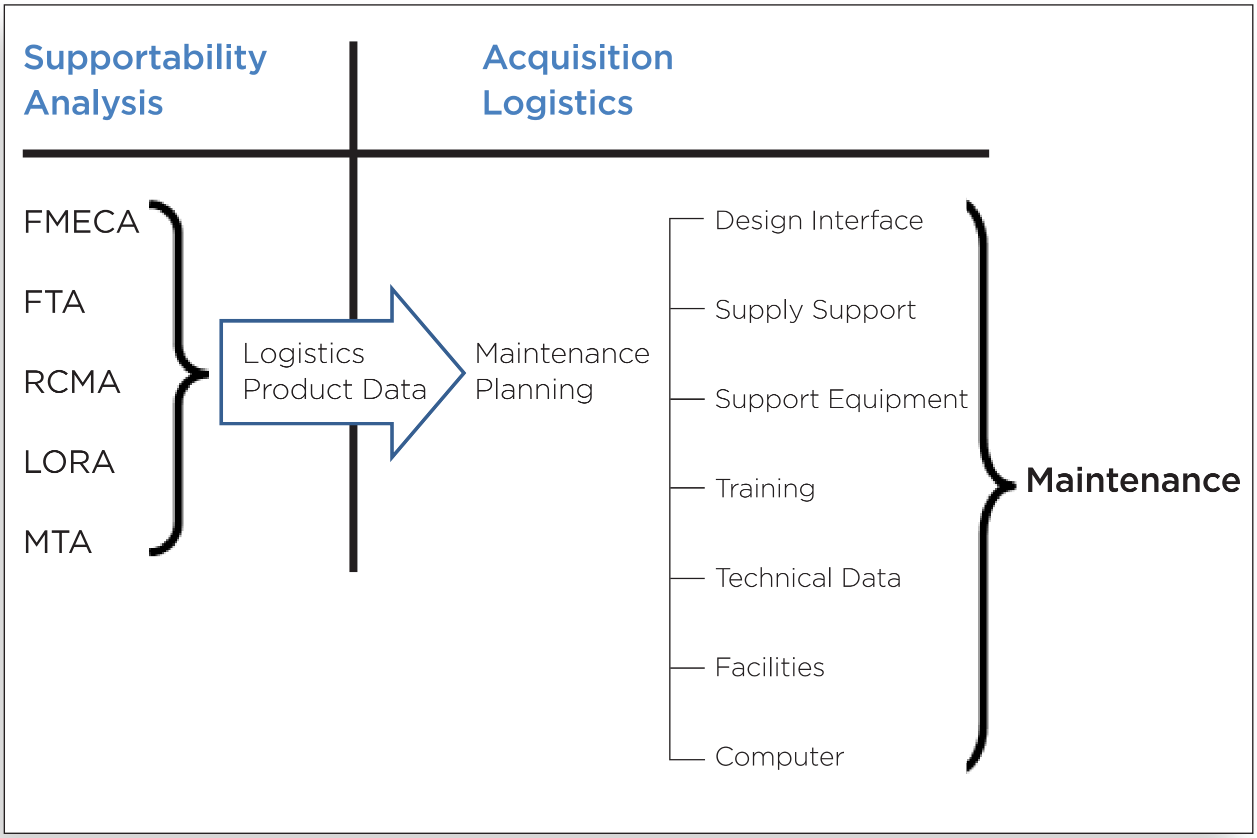
- Failure Mode
- Effects and Criticality Analysis (FMECA)
- Fault Tree Analysis (FTA)
- Reliability Centered Maintenance Analysis (RCMA)
- Level of Repair Analysis (LORA)
- Maintenance Task Analysis

Who conducts the analyses, or where they are conducted, isn't the most important aspect of supportability analysis to the LCL. The data they generate *are* important. Those data, tailored to enhance usability by engineering and logistics, are called logistics product data. These data, the output of the supportability analysis process, will be needed by LCLs to build efficient and effective product support packages.

The LCL takes the logistics product data and uses them in the maintenance planning process to formulate a maintenance plan for the system. Maintenance planning is the translation of engineering data and analysis into executable maintenance actions and the identification of the required logistics support elements required to conduct maintenance.

It's important to note that maintenance planning is different from the maintenance plan. The maintenance plan is a physical deliverable that reflects the composite results of supportability analysis, identification of logistics support elements, and an exact description of how maintenance will be accomplished while maintaining the system's operational readiness. The names are similar, but it's important to keep in mind that maintenance plans are the product of the process called maintenance planning.

A diagram of what we've discussed so far:



A general overview of the supportability analysis tools:

Failure Mode, Effects, and Criticality Analysis (FMECA): FMECA is a methodical process to identify all the probable ways that parts, assemblies, and the system may fail, the causes for each failure, and the effect of that failure on the capability of the system to perform its mission. This identification of risks is essential in the system design process.

FMECA is a reliability evaluation/design technique that examines the potential failure modes within a system and its equipment, to determine the effects on equipment and system performance. Each potential failure mode is classified according to its impact on mission success and personnel/equipment safety.

Primary Purposes for FMECA:

- Hazard Elimination
- Mission Capability
- Diagnostic Development
- Support Planning

Key FMECA Participants:

- Systems Engineering
- Design Engineering
- Reliability Engineering
- Maintainability Engineering
- Safety Engineering
- Supportability Engineering
- Logistics Engineering

The FMECA facilitates identification of potential design reliability problem areas which must be eliminated, or their effects minimized, by design modification or tradeoffs. Specific defects identified can include:

- Circuit failures that may cause failure of a related critical circuit
- Areas where fail safe features are required
- Primary failures that may cause costly secondary failures

Knowledge and information gained by performing the FMECA also can be used as a basis for troubleshooting, maintenance manual development, and design of effective built-in test methods of procedure.

An FMECA should be scheduled and completed concurrently as an integral part of the design process. The analysis should begin early in the conceptual phase of design, when the design criteria, mission requirements, and performance parameters are being developed. To be effective, the final design should reflect and incorporate the analysis results and recommendations.

The results of both the functional and hardware FMECAs must be presented at each of the design reviews. The design reviews then serve as a forum to modify, correct, or update the system reviews. Because an

FMECA is used to support maintainability, safety, and logistics analysis, it is important to coordinate the analysis to prevent duplication of efforts within the program.

It's important to note that the FMECA is a repetitive process. As the design becomes mature, the FMECA must reflect the additional details. When changes are made to the design, an FMECA must be performed on the redesigned sections. This ensures that the potential failure mode or the revised hardware will be addressed. If the FMECA is performed correctly, it becomes an important tool for making program decisions regarding considered design integrity.

Another aspect of the FMECA is that it can be performed by a design engineer, reliability engineer, independent evaluator, or any of the previously mentioned combinations who have a thorough understanding of the operation and application of the system or product analyzed. The analysts then can provide feedback data gained from the FMECA into the design process to acquire effective and timely corrective action implements.

Fault Tree Analysis (FTA): A fault tree analysis (FTA) analyzes high-level failures and identifies all lower-level (subsystem) failures that cause it. Generally, the undesired event constitutes the highest-level (top) event in a fault tree diagram and represents a complete or catastrophic failure of the system.

The FTA is useful during the initial product design phase as a tool for driving the design through an evaluation of both reliability and fault probability perspectives. From a reliability perspective, the FTA can be used to estimate a system's performance reliability requirements. The probability evaluation determines the likelihood of the undesired event, which can be used to quantify risk or safety hazards.

Fault tree methods of analysis are particularly useful in functional paths of high complexity in which the outcome of one or more combinations of noncritical events may produce an undesirable critical event. Typical candidates for fault tree analysis are functional paths or interfaces that could have critical impact on flight safety, munitions handling safety, safety of operating and maintenance personnel, and probability of error-free command in automated systems in which a multiplicity of redundant and overlapping outputs may be involved. The fault tree provides a concise and orderly description of the various combinations of possible occurrences within the system that can result in a predetermined critical output event.

As was previously mentioned, an FMECA is considered a "bottom-up" analysis, whereas an FTA is considered a "top-down" analysis. FMECAs and FTAs are compatible methods of risk analysis, with the choice of method dependent on the nature of the risk evaluated. There are some differences. Because FTA is a top-down analysis, there is a higher probability of misinterpretation at the lowest level. On the other hand, with the FMECA starting at the lowest level, it probably will result in a better method of risk analysis (assuming lowest-level data are available). Also, the FMECA considers only single failures, while FTA considers multiple failures that will impact accuracy.

As a recap, Fault Tree Analysis provides insight into the following supportability analysis areas:

- Functional analysis of highly complex systems
- Observation of combined effects of simultaneous, noncritical events on the highest-level event
- Evaluation of safety requirements and specifications
- Evaluation of system reliability
- Evaluation of human interfaces
- Evaluations of software interfaces
- Identification of potential design defects and safety hazards
- Evaluation of corrective actions
- Identification and simplification of maintenance requirements and troubleshooting procedures
- Elimination of causes for observed failures

Reliability-Centered Maintenance Analysis: The RCM analysis is a systematic approach for identifying preventative or scheduled maintenance tasks for an equipment end item and establishing necessary preventative (or scheduled) maintenance task intervals. A key objective of the RCM analysis is to develop a maintenance schedule that would ensure that reliability of a system is enhanced. In essence a maintenance task would be implemented prior to the failure.

Using the decision tree process of RCM analysis, a complete analysis of each functional significant item and its assigned failure modes can be conducted. MIL-STD-2173 (Reliability Centered Maintenance Requirements for Naval Aircraft, Weapons Systems, and Support Equipment), as well as MSG-3 (Maintenance Steering Group 3—the root of all inspection schedules in a process starting before an aircraft enters service) give detailed instructions and provide a guide for RCM analysis. The results of the analysis provide a clear decision as to which preventive maintenance tasks should be developed to support the system. Sample RCM logic diagrams can be found in MIL-STD-2173. The results of the RCM logic should be documented and retained in an official report. (This can be accommodated in the logistics system analysis report (LSAR) as per MIL-STD-1388/2B)

As electronics failure patterns (rates) generally exhibit a constant failure rate, the RCM analysis will have its most impact on electromechanical and mechanical-based maintenance activities. The RCM analysis, when used in conjunction with the FMECA can be used to identify potential hidden safety-related failures for electronic systems. When the RCM analysis is used with the FMECA early in the design process, safety-related failure modes can be removed from the system during the design phase. As the maturity of the design progresses, this option becomes increasingly more difficult and expensive to address.

Level of Repair Analysis (LORA): LORA (also referred to as repair-level analysis [RLA]) is an analytical methodology used to determine at which maintenance level (organizational, intermediate, or depot) an item will be replaced, repaired, or discarded. These determinations are based on cost considerations, support equipment distribution efficiency, and operational readiness requirements.

The LORA is assisted by several associated analyses, which include:

- Reliability & Maintainability (R&M) predictions
- Failure Mode, Effects and Criticality Analysis (FMECA)
- Logistics Support Analysis (LSA)
- Reliability-Centered Maintenance Analysis (RCMA)
- Reliability Availability Maintainability and Cost (RAM-C) Rationale Report generation

Using the LORA, program personnel examine the costs of replacing or repairing the component under consideration. Its primary purpose is to minimize equipment life cycle support costs by identifying the most cost-effective maintenance concept.

When conducting a LORA, site populations of failed hardware components are estimated using equipment reliability (failure) data and fleet (equipment) operations data. After identifying maintenance resources required for component repair, the LORA evaluates the workload distribution among the proposed repair sites. It then calculates the costs of spares and resources for each site or maintenance concept.

Possible options for a LORA to consider when items fail are:

- Repair at the level of the operating end-item (for example, an aircraft)—that is, the organizational (“O”) level.
- Repair at the intermediate (“I”) level (usually the repair shop on the base or ship).
- Repair at a military depot (“D”), or the manufacturer.
- Discard (“X”) if impractical, too costly, or damaged to repair.

Once the repair echelon (O, I, D, or X) and site are established by the LORA, they will be provisioned with the spares, test equipment, and other resources needed to perform assigned repairs. If repair costs exceed what is considered cost-effective, the LORA identifies the level of maintenance where it is most economical to discard the component.

If the LORA is performed incorrectly or the maintenance concepts identified in the LORA are not resourced adequately, readiness issues will surface. Any logistics shortfall will first show itself as a supply issue.

Implementing results from a poorly performed LORA/poorly resourced implantation:

- Longer repair ("failure duration") times.
- Stressed fix-to-fail ratio.
- Shortages of the high-level spares swapped out with the equipment entering the shop (WRAs).
- Degraded end-item (e.g., aircraft) availability. (Some types of shortages merely degrade aircraft performance; others can ground the aircraft.)
- LORA does not increase equipment Quantity, equipment Availability, or program Capability.
- LORA applies to all maintenance-worthy acquisitions and in-service programs when significant maintenance factors change. It also provides the economic justification to change existing maintenance plans.

Maintenance Task Analysis (MTA): Maintenance task analysis is the identification of the steps, spares and materials, tools, support equipment, personnel skill levels, as well as any facility issues that must be considered for a given repair task. Also included in the MTA are elapsed times required for performance of each task. MTAs cover both corrective and preventative maintenance tasks and, when complete, identify all physical resources required to support a system.

Performing an MTA begins with identifying each step of the repair process. The steps are analyzed and a description written as to how they would be physically performed. After the description, resources to perform that task are identified.

These resources include:

- Person(s) participating in each step, including a narrative description of what they are doing
- Time duration of each person's participation
- Tools or support equipment required
- Parts and materials needed for the step

Once the above activities are complete, the results are analyzed to determine the following:

- The total elapsed time for the task, start to completion
- The skill level of the person (or persons) required to perform the task based on minimum technical capabilities, knowledge, and experience
- Any additional training that must be provided to ensure proper task performance
- Any facility implications such as space limitations, environmental controls, health hazards, or minimum capacity requirements.

Finally, the MTA results must be analyzed to assess the items' compliance with all supportability issues such as ease of maintenance or accessibility and standardization that may have been established by earlier analytical tools or functional analyses. The source for comparison of the physical support requirements for acceptability should be the requirements documents (ICD/CDD/CPD). Many of these design limitations may be derived from actual state requirements. Any shortfalls or noncompliant features must be reported to the design organization (vendor) for correction. This closes the loop between requirements for the design and the actual results of the design process.

Supportability Objectives in the Maintenance Concept: The maintenance concept is a general statement used in supportability analysis to set the parameters for the various support analyses and the maintenance plan. In other words, the maintenance concept is the users' idea of how they envision maintenance being accomplished. It's important to note that while the maintenance concept is the "vision," it is the maintenance plan that reflects the final decision on how maintenance will be accomplished. (Please remember, maintenance planning is the process; the maintenance plan is the outcome of that process.) Because concepts are formed in the early phases of the acquisition process, there is greater flexibility in allowing for change.

A few general guidelines to consider when establishing the system's maintenance concept:

- Anticipated levels of repair
- General overall repair policies such as "repair or replace" criteria
- Organizational responsibilities for maintenance
- Anticipated availability of resources
- Use of contractors, both CONUS and OCONUS
- Statutory and Regulatory maintenance guidance

A maintenance concept is a brief description of the maintenance considerations, constraints, and plans for operational support of the system/equipment under development. A preliminary maintenance concept is developed and submitted as part of the preliminary system operational concept for each alternative solution candidate by the operating command with the assistance of the implementing and supporting commands. The maintenance concept is a major driver in designing the system and its planned support. For example, if it is a service's policy to have only two levels of maintenance for repair, the acquisition program office will have to work within that boundary to balance the system's repair requirements with the higher authority's policy.

The user is the warfighter—the primary stakeholder in system performance and supportability. There are, however, other stakeholders involved in developing and executing the product support strategy. The maintenance concept provides the "trade space" in which a more detailed maintenance plan can be developed. The boundaries in the trade space are often statutory/regulatory guidance, Joint/Service policies, financial considerations, and the intended operational environment.

The maintenance concept with respect to designing and developing a weapon system: As stated previously, one element of the maintenance concept describes the warfighter's approach to maintaining the system once it is fielded. As such, the maintenance concept is a major driver in the system design process. How the maintenance concept is implemented by the warfighter will determine what, where, and how much logistics support is needed.

As part of the JCIDS process, the warfighter develops a CONOPS that describes the user's desires, visions, and expectations regarding the operation of the weapon system. A portion of this description discusses maintenance and support of proposed products or services. The maintenance concept expressed in the CONOPS is the key characteristic that sets the stage for developing asset supportability and logistics program requirements.

The initial maintenance concept provides broad guidance on the desired approach to maintaining the weapon system. This information is incorporated into the system engineering (SE) process during early design work. More specifically, the maintenance concept becomes an important parameter in supportability analysis in that it begins to define the range of support requirements and options that will be available in the maintenance plan.

Maintenance concept requirements and constraints are translated into system design and support requirements. As the system design activities are performed, the maintenance concept continues to shape design decisions and detailed maintenance and product support requirements.

Maintenance concepts result from a combination of warfighter capability and performance needs, statutory (law) requirements, regulatory guidance (e.g., DoD and Service regulations, instructions, and orders), and policy decisions that guide DoD acquisitions.

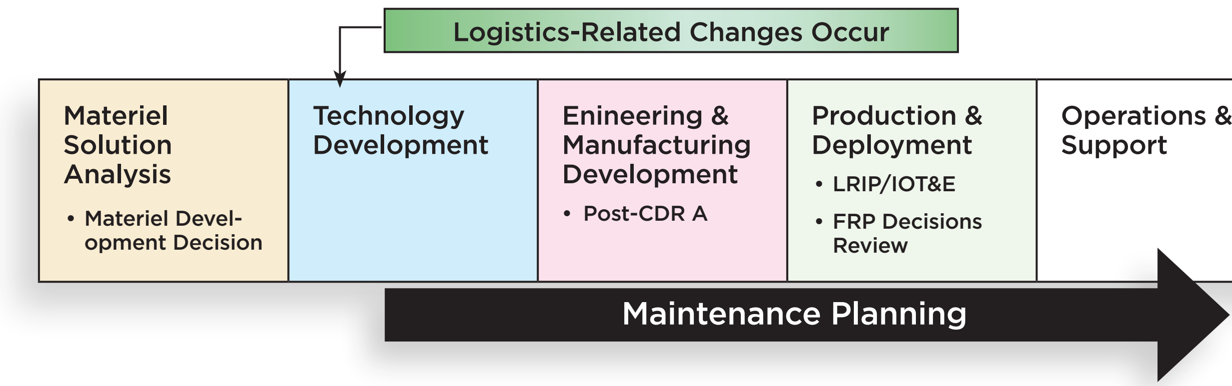
Examples of how these parameters guide maintenance concept development include:

- Joint/Combined Service usage
- CONOPS
- Affordable Operational Effectiveness
- Technical Data
- Training Constraints
- Performance Based Life Cycle Product Support (i.e., Performance Based Logistics)
- Contractor Logistics Support
- Statutory (U.S.C. Title 10)

Changes to a maintenance concept occur only if there are major changes in the warfighter's operational/mission profile, changes to statutory/regulatory requirements, and/or changes in DoD/Service policy or guidance.

Maintenance Planning. Maintenance planning is the development process that defines the repair and upkeep tasks, schedule, and resources required to care for and sustain a weapons system with the focus on defining the actions and support necessary to attain the system's operational availability (A_o) objective. It is considered part of the LCSP development, starting as early as the Technology Development Phase in the system's acquisition. Maintenance planning utilizes concepts such as Reliability-Centered Maintenance (RCM), Condition-Based Maintenance Plus (CBM+), and Total Ownership Cost (TOC) to create a plan that will lead to an efficient maintenance concept. Once the maintenance concept is derived, level of repair analysis (LORA), maintenance task analysis (MTA), and related technical data are used to build the foundation to establish the maintenance plan.

Maintenance Planning should be initiated as soon as design alternatives are defined, to influence the design for supportability, and continue throughout the life cycle whenever logistics-related changes occur.



Maintenance (materiel)—as defined by DoD:

- All action taken to retain materiel in a serviceable condition or to restore it to serviceability. It includes inspection, testing, servicing, and classification as to serviceability, repair, rebuilding, and reclamation
- All supply and repair action taken to keep a force in condition to carry out its mission
- The routine recurring work required to keep a facility (plant, building, structure, ground facility, utility system, or other real property) in such condition that it may be continuously used at its original or designed capacity and efficiency for its intended purpose

Planning for maintenance involves two very broad concepts in the type of maintenance performed: corrective and preventive. Together, they work to balance operational readiness required by the warfighter and economical operation required by DoD.

Corrective Maintenance—The concept of corrective maintenance is to "fly it till it breaks." This is acceptable as long as the failure does not result in the potential loss of equipment and/or human life. The primary benefit of corrective maintenance is the reduction of support costs since noncritical systems aren't needlessly monitored. The downside is the unknown timing of a failure and the impact to system availability and mission completion. The LCL must understand the impact corrective maintenance will have on all ILS elements—i.e., sparing, test equipment, personnel, etc.

Preventive Maintenance—The care and servicing by personnel for the purpose of maintaining equipment and facilities in satisfactory operating condition by providing for systematic inspection, detection, and correction of incipient failures either before they occur or before they develop into major defects. The concept of preventive maintenance (PM) is to "fix it before it breaks." PM attempts to prevent critical failures by determining potential failure rates. These failure rates could be based on operating hours, calendar days, landings, takeoffs, etc. Condition Based Maintenance Plus (CBM+) is one of the tools developed to identify component service life so preventive maintenance intervals can be established to replace the component before it fails. Better than "fly it till it breaks," but more expensive in development and support costs, CBM+ still is cheaper than buying extra aircraft to compensate for anticipated losses/attrition.

The benefit is the obvious inverse relationship to corrective maintenance—the elimination of surprise failures with associated enhanced operational availability and the ability to forecast future maintenance. Without the enhancement of CBM+, RCM, or other Prognostic and Health Management systems, traditional PM drove removing and replacing components based on generic, worst-case operating intervals which, in most cases, were much too frequent. Very few components are used in a worst-case environment. But in the absence of technology to predict failure, designers had little choice but to err on the side of safety. Traditional PM can increase sustainment costs by removing and inducting components for repair that aren't really broken. Such initiatives as CBM+, RCM, and health monitoring technology (e.g., the Prognostics and Health Management subsystem on the Strike Talon) are intended to reduce this impact, but require upfront investment to achieve future savings. Preventive maintenance schedules drive logistics requirements, and those requirements must be translated into resources during the budget process.

The maintenance planning process is built on the concept of operation and forms the foundation for developing the warfighter's prescribed level of system availability. The outputs of the maintenance planning process—e.g., maintenance plans and associated maintenance task requirements—drive associated logistics requirements and LCC levels that may make an unaffordable system affordable or vice versa. The maintenance planning process is critical element in the developing the LCSP during the Integrated System Design phase of EMD. It should be accomplished prior to the Post CDR A review.

The focus of the maintenance planning process is to:

- Delineate accessibility, diagnostics, repair, and sparing requirements
- Identify requirements for manpower factors that impact system design utilization rates (e.g., maintenance man-hours per maintenance action, maintenance ratios, etc.)
- Identify life cycle supportability design, installation, maintenance and operating constraints, and guidelines
- Confirm that maintenance planning and analyses are consistent with the requirements of U.S.C. Title 10 regarding Core Logistics Capability (i.e., CORE) and public/private partnering
- Provide economic and noneconomic LORA

As a result of the maintenance planning process, specific criteria for repair and maintenance at applicable levels of maintenance are identified as discrete measures related to time, accuracy, repair levels, built-in-test (BIT), testability, reliability, maintainability, support equipment requirements (including automatic test equipment), manpower skills, knowledge and abilities, and facility requirements for peacetime and wartime environments. The results of the maintenance planning process are then incorporated into a maintenance plan.

Maintenance Plan. Though similar in name, maintenance planning and maintenance plans are two very different concepts. A maintenance plan evolves from the maintenance concept and shows maintenance requirements and resources needed to maintain a specific piece of equipment. Specifically, a maintenance plan describes how the maintenance concept will be implemented, prescribes actions for each significant maintenance task that will be required for the system/equipment during its life cycle, explains technical requirements (where and how maintenance will be performed), incorporates detailed support concepts and resource requirements, lists the significant consumable items, and lists for each repairable item the supply, maintenance, and recoverability requirements/sources.

However, maintenance planning (and development of a maintenance plan whether stand-alone or as a subset of a larger logistics support plan, life cycle management plan, etc.) should be performed, documented, and refined well before a Milestone C decision. There is a clear, consistent, and symbiotic relationship between early design influence, achieved via a focus on Systems Engineering (SE), and an effective product support strategy.

Summary

The LCL should recognize that a system's design determines how effectively and efficiently it can be supported. Implementation of a disciplined and repetitive process that includes key SE activities such as Failure Modes, Effects, and Criticality Analysis (FMECA), Fault Tree Analysis (FTA), and Reliability-Centered Maintenance (RCM) are necessary to produce a comprehensive Maintenance Task Analysis (MTA). From the MTA and its associated support tasks, the LCL can construct a product support package that optimizes the system's reliability, maintainability, and supportability objectives. This, in turn, produces an operationally reliable and effective system for the warfighters. The Level of Repair Analysis (LORA) and development of maintenance/repair procedures and other technical data all flow from a robust, disciplined systems engineering and supportability analysis process. The maintenance concept, maintenance/repair procedures, and ultimately the maintenance plan for a system, all are linked inextricably.

Supportability analysis, part of the iterative systems engineering process, is used to identify supportability requirements, then supportability design constraints, and then the required product support. Supportability analysis is part of requirements generation and analysis and continues through design, test and evaluation, production, and fielding of the new system.

Supportability analysis defines and specifies product support resources (people, parts, pubs, tools, and test equipment) required by analytically developed maintenance plans. They constrain the design of the hardware system by the interface it has with the product support environment in which it must operate. The supportability analysis process provides data that are recorded in the GEIA-STD-0007 Logistics Product database used as a common source data base (CSDB) to identify the logistics element resource requirements of the new system.

Therefore, the LCL must be an active participant in supportability analysis to ensure that supportability concerns are identified early in the design process, system performance as it relates to supportability is established, required support elements are documented, and a proper balance is maintained between performance, product support, and total ownership cost.

[4] DoD Joint Publication 1-02, dtd 12 April 2001, as amended through 04 March 2008.
[5] NAVSO P-3692 Department of the Navy, Independent Logistics Assessment Handbook,
[5] NAVSO P-3692 Department of the Navy, Independent Logistics Assessment Handbook, September 2006.

Homework

Read:

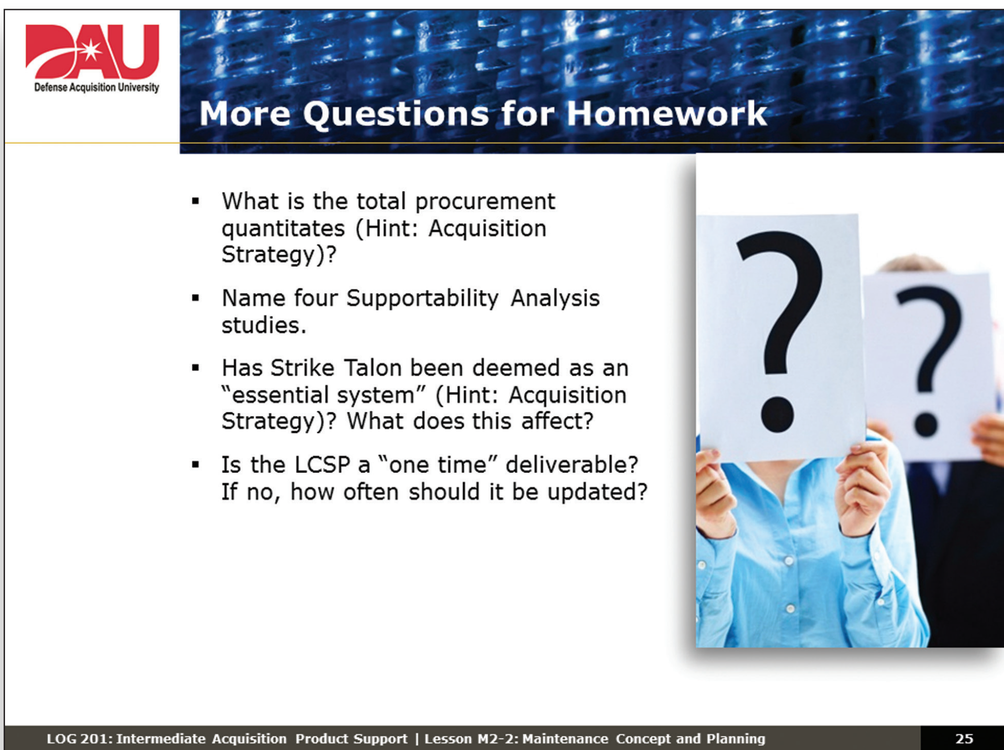
Lesson 3-1 Reading Section:

"Designing for Supportability—Driving Reliability, Availability and Maintainability In While Driving Costs Out" by Patrick M. Dallosta and Thomas A. Simcik, *Defense AT&L* magazine, March–April 2012.

Lesson 3-2 Reading Section:

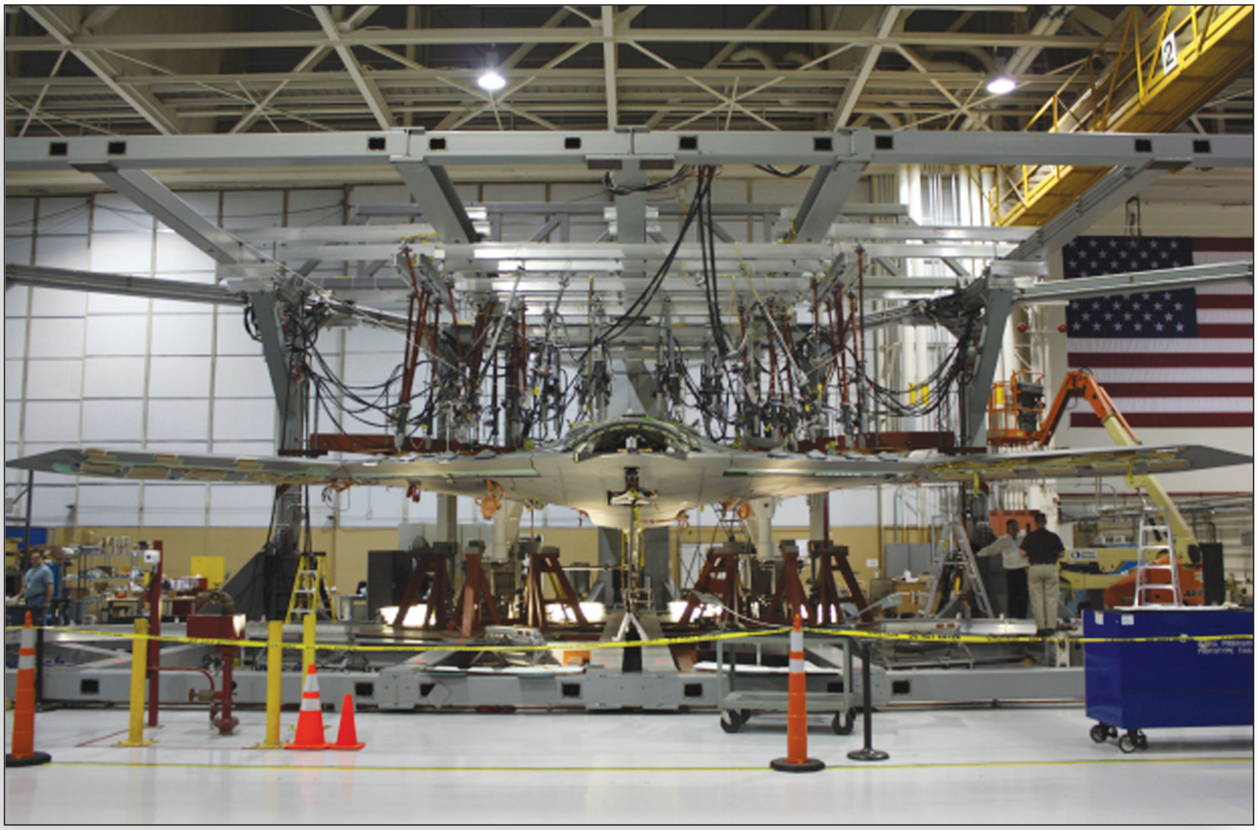
"OK, We Bought This Thing, but Can We Afford to Operate and Sustain It?" by Mike Taylor and Joseph "Colt" Murphy, *Defense AT&L* magazine, March–April 2012.

And answer the following questions. (Use your class notes and the program documents to answer.)



Lesson 3-1

Reliability & Performance

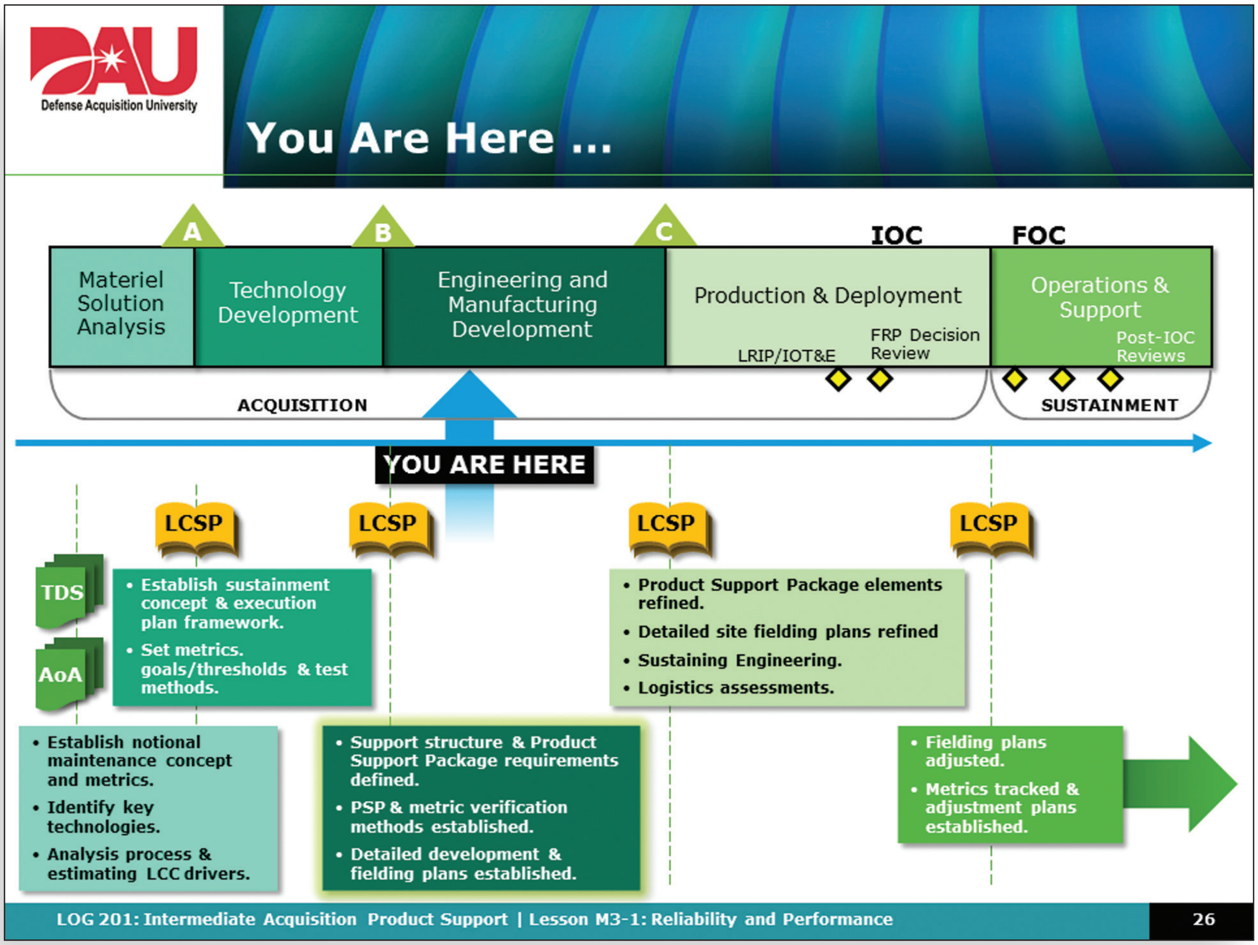


Lesson Objectives:

- Given background information, policies, and instruction material, define reliability growth.
- Given program, policy, and framework documents, explain the effect of reliability growth on Product Support Planning.
- Given program, policy, and framework documents, Integrated Product Support Elements and reliability data, develop courses of action to improve Product Support.
- Given program, policy, and framework documents, Integrated Product Support Elements and reliability data, update the Strike Talon Program's LCSP.

What's In It for Me?

- You will understand reliability implications with regard to performance.
- You will understand the key function of materiel reliability in supporting the Availability KPP.
- You will understand the importance of data and their collection in the evaluation of system performance.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Technology Development
Engineering and Manufacturing Development
Production & Deployment
FRP Decision Review
LRIP/IOT&E
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AoA
• Establish sustainment concept & execution plan framework.
• Set metrics. goals/thresholds & test methods.
• Product Support Package elements refined.
• Detailed site fielding plans refined
• Sustaining Engineering.
• Logistics assessments.
• Establish notional maintenance concept and metrics.
• Identify key technologies.
• Analysis process & estimating LCC drivers.
• Support structure & Product Support Package requirements defined.
• PSP & metric verification methods established.
• Detailed development & fielding plans established.
• Fielding plans adjusted.
• Metrics tracked & adjustment plans established.
LOG 201: Intermediate Acquisition Product Support | Lesson M3-1: Reliability and Performance
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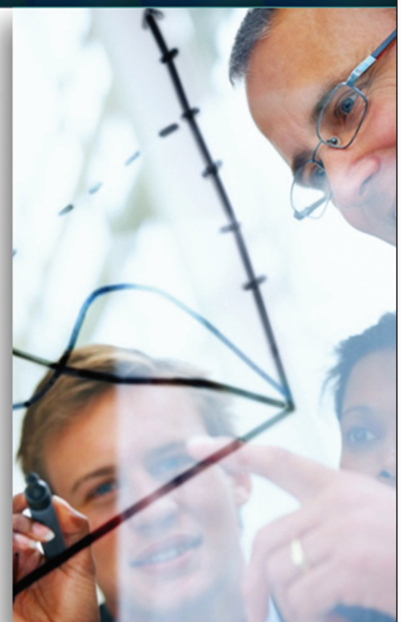
Notes:

Reliability Growth

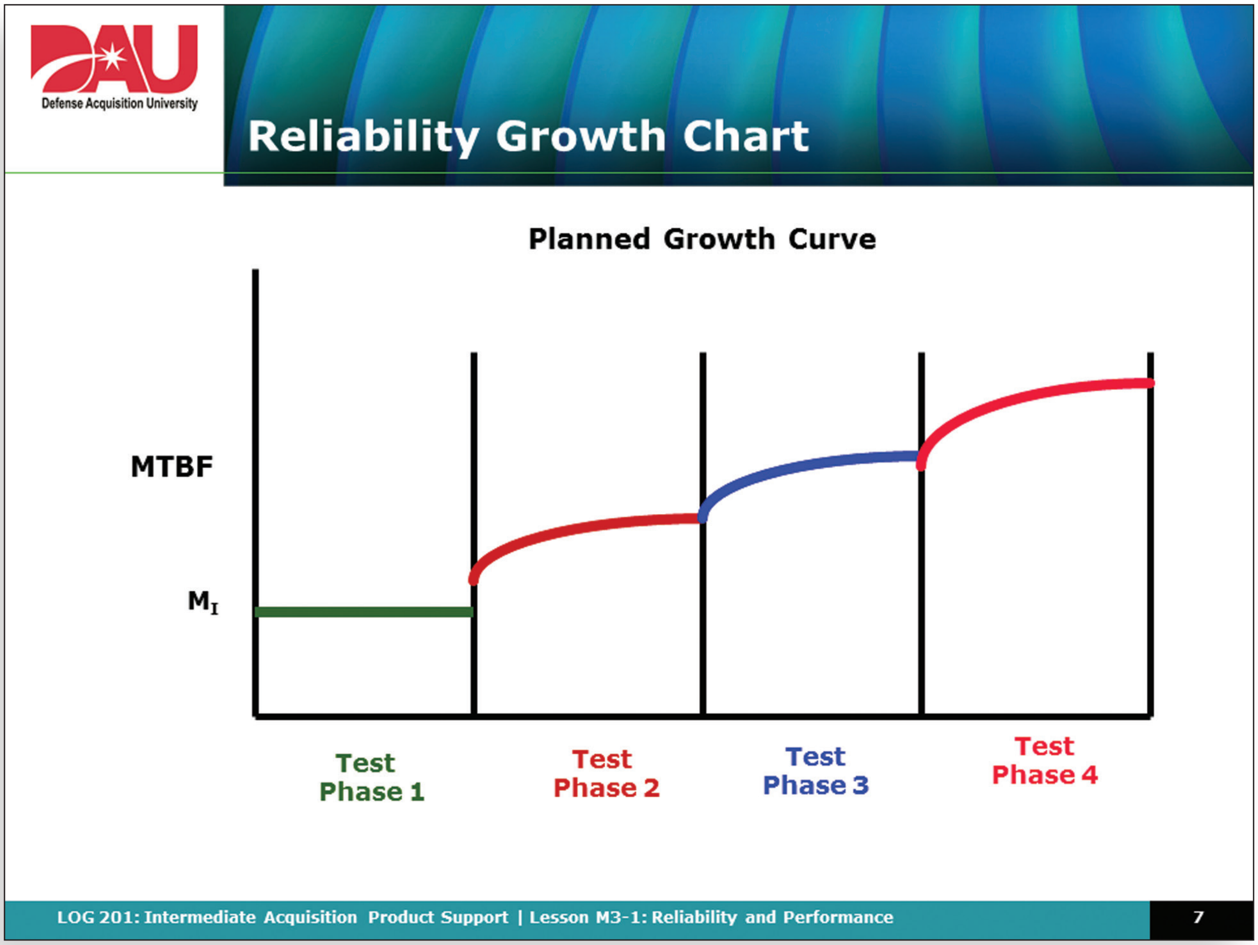
- **What is reliability growth?**
  - The improvement in system reliability over time due to analyzing and fixing failure modes
- **Implementation of Test, Analyze and Fix (TAAF)**
  - Reliability growth modeling
  - Reliability improvements through analyzing and fixing failure modes



LOG 201: Intermediate Acquisition Product Support | Lesson M3-1: Reliability and Performance 6

Notes:

Source: MIL-HDBK-00189A — 10 September 2009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Reliability Growth Chart
Planned Growth Curve
MTBF
M_I
Test Phase 1
Test Phase 2
Test Phase 3
Test Phase 4
LOG 201: Intermediate Acquisition Product Support | Lesson M3-1: Reliability and Performance
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Notes:

Reliability Growth—Requirement

Directive-Type Memorandum (DTM) 11-003—Reliability Analysis, Planning, Tracking, and Reporting

- Program Managers (PMs) *shall* formulate a comprehensive reliability and maintainability (R&M) program using an appropriate reliability growth strategy to improve R&M performance until R&M requirements are satisfied.
- The lead DoD Component and the PM, or equivalent, *shall* prepare a preliminary Reliability, Availability, Maintainability, and Cost Rationale Report … in support of the Milestone (MS) A decision.

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Notes:

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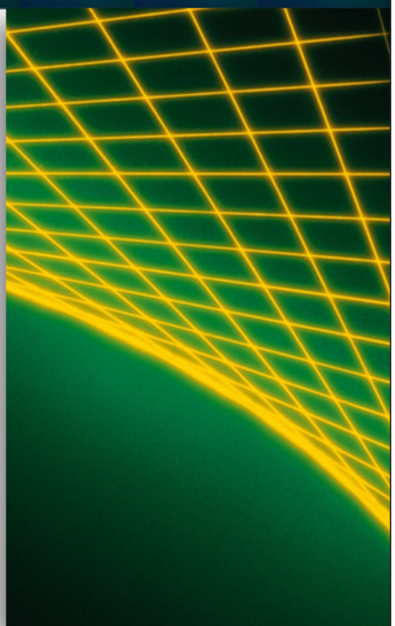
So What?
An Opportunity for Reflection...

- What does this mean to the Life Cycle Logistician?
- Measures of availability
  - $A_i = \frac{MTBF}{MTBF+MTTR}$
  - $A_a = \frac{MTBM}{MTBM+MCT+MPT}$
  - $A_o = \frac{MTBM}{MTBM+MDT}$
- Availability is a KPP (mandatory)
- Availability is calculated based on reliability, maintainability and logistics delay time (refer back to lesson 1-2)
- Influencing reliability can have a significant affect on availability



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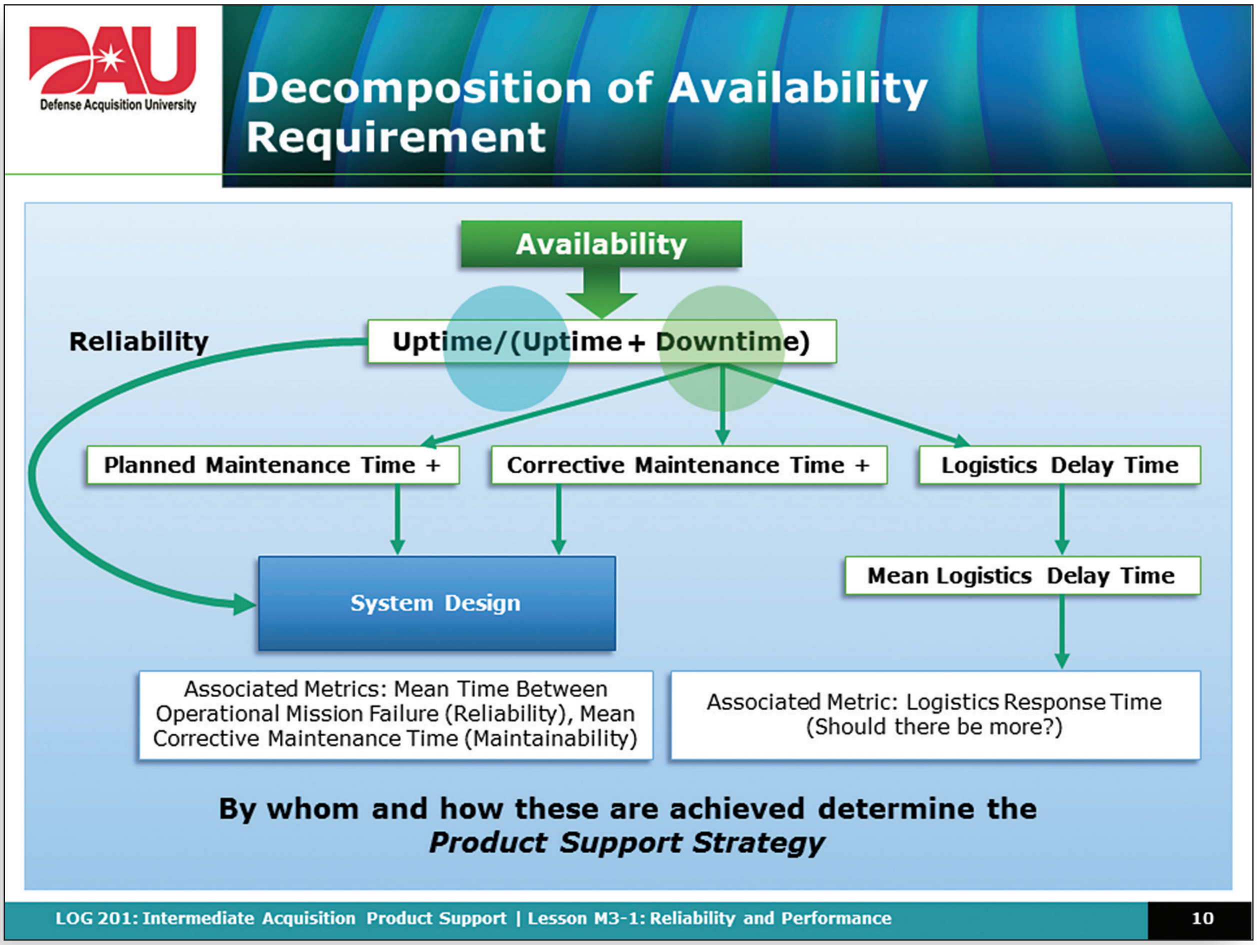

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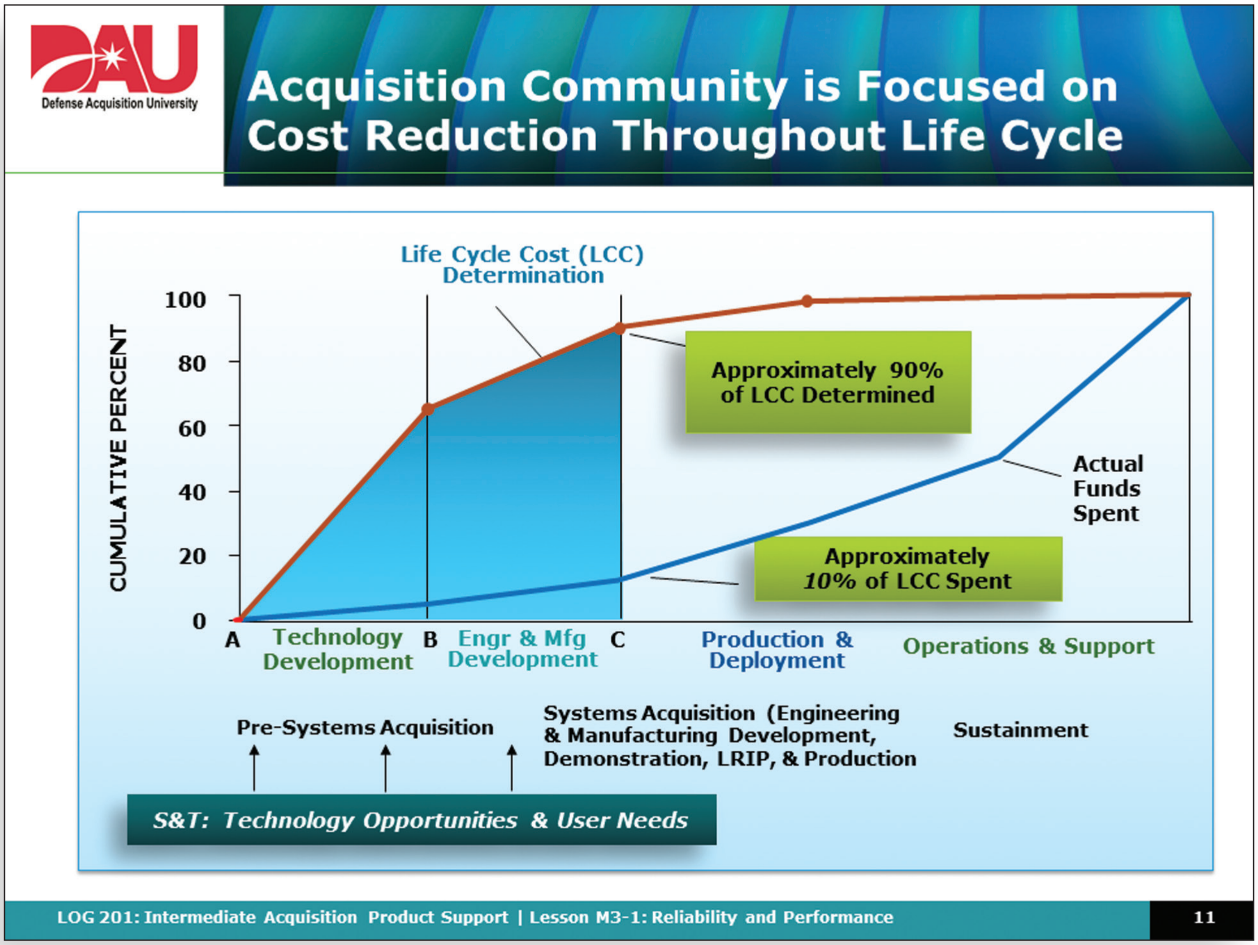
Remember this?


Defense Acquisition University
Acquisition Community is Focused on Cost Reduction Throughout Life Cycle
Life Cycle Cost (LCC) Determination
100
80
60
40
20
0
CUMULATIVE PERCENT
Approximately 90% of LCC Determined
Actual Funds Spent
Approximately 10% of LCC Spent
A
Technology Development
B
Engr & Mfg Development
C
Production & Deployment
Operations & Support
Pre-Systems Acquisition
Systems Acquisition (Engineering & Manufacturing Development, Demonstration, LRIP, & Production
Sustainment
S&T: Technology Opportunities & User Needs
LOG 201: Intermediate Acquisition Product Support | Lesson M3-1: Reliability and Performance
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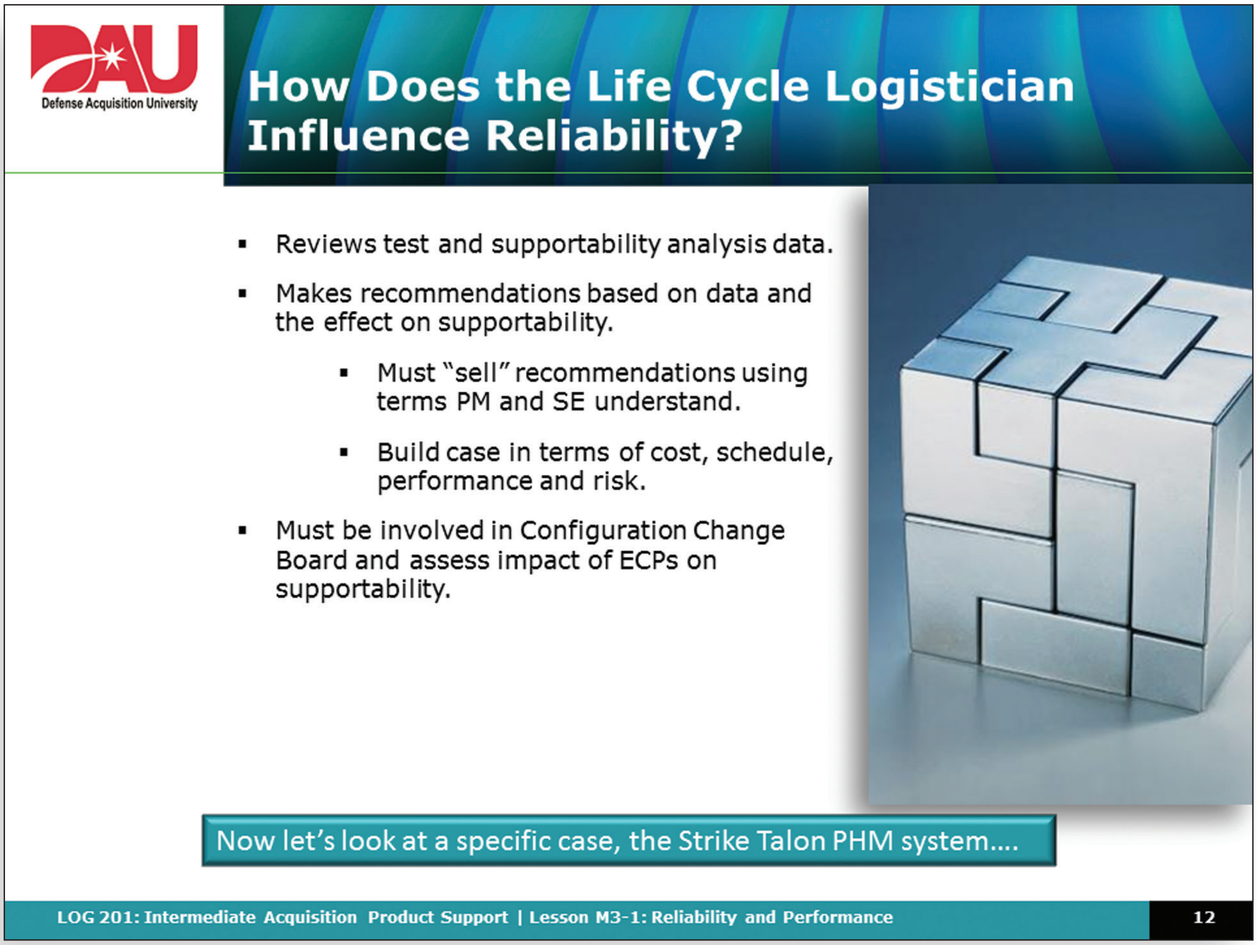
Defense Acquisition University
How Does the Life Cycle Logistician Influence Reliability?
Reviews test and supportability analysis data.
Makes recommendations based on data and the effect on supportability.
Must "sell" recommendations using terms PM and SE understand.
Build case in terms of cost, schedule, performance and risk.
Must be involved in Configuration Change Board and assess impact of ECPs on supportability.
Now let's look at a specific case, the Strike Talon PHM system....
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Notes:

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PHM Subsystem R&M Metrics

- **MFHBFA**—average time (flying hours) between false alarms (PHM system indicating a system failure when there is none). (Total Flying Hours/Total # of False Alarms)
- **FDetcov**—Due to funding/other constraints, PHM may be designed to detect some, but not all, foreseeable failure modes. (FDetcov=# of BIT failures/total # of failure modes)
- **FIsol1**—The significance of this measurement is that the more potential to troubleshoot to a single WRA, which lowers the MTTR, which lowers MMT, which increases A_0. (# of BIT failures isolated to 1 WRA/# of BIT indications correct)
- **FIsol2**—The significance of this measurement to FIsol1 (for Strike Talon), is that the PHM isolates the fault to two (or one) WRA, which may increase MTTR and MMT and thereby decrease A_0. (# of BIT failures isolated to two or one WRA divided by the # of BIT indications correct)

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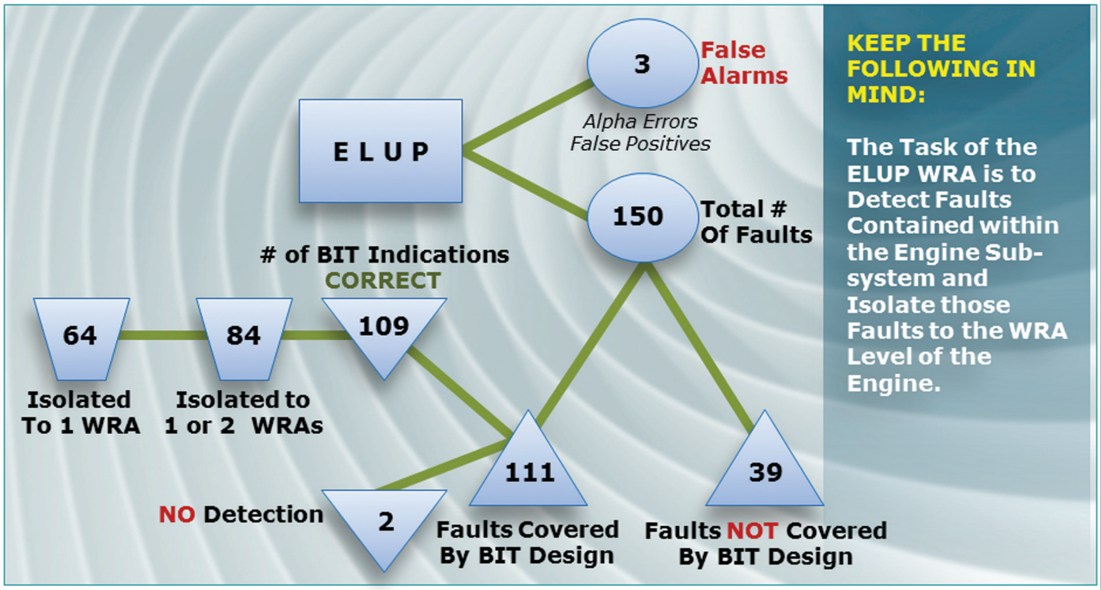
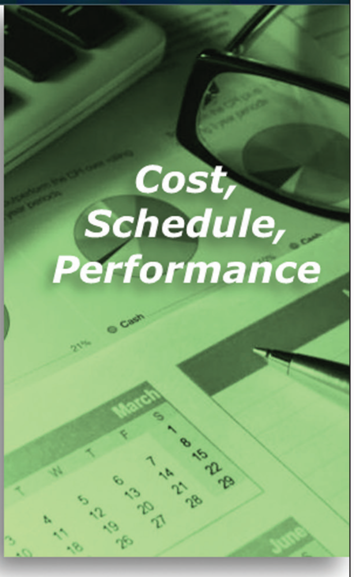
Description of PHMS Logic



Exercise: Takeaways

- **Can we achieve our Ao if our reliability is subpar?**
- **Through input to the contract specification (Requirements and Verification Sections), the logistician will influence Developmental Testing to assure a supportable design.**
- **Evaluation of DT data provides the logistician with insight into:**
  - Logistics-related *design characteristics* (e.g., R&M), support costs, and field performance (availability).
  - Refinement of *support structure requirements* (facilities, tools, test equipment, manpower, etc.).
- **What terms do we use when presenting our case to the PM for product support?**



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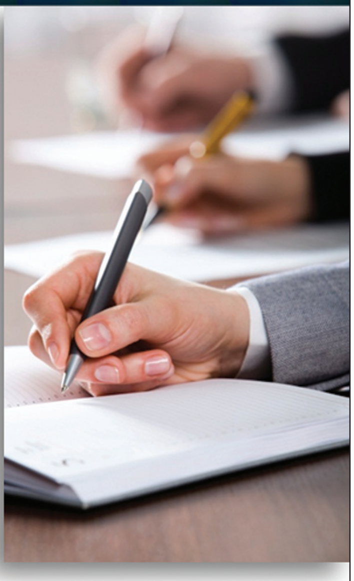
Time to Update the LCSP

- **What Sections Need Updating?**

Sections:

- 1 Introduction
- 2 Product Support Performance
- 3 Product Support Strategy
- 4 Product Support Arrangements
- 5 Product Support Package Status
- 6 Regulatory/Statutory Requirements That Influence Sustainment Performance
- 7 Integrated Schedule
- 8 Funding
- 9 Management
- 10 Supportability Analysis



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Life Cycle Sustainment Plan Outline

SECTIONS

1 Introduction
2 Product Support Performance
3 Product Support Strategy
4 Product Support Arrangements
5 Product Support Package Status
6 Regulatory/Statutory Requirements That Influence Sustainment Performance
7 Integrated Schedule
8 Funding
9 Management
10 Supportability Analysis
11 Additional Sustainment Planning Factors
12 LCSP Annexes

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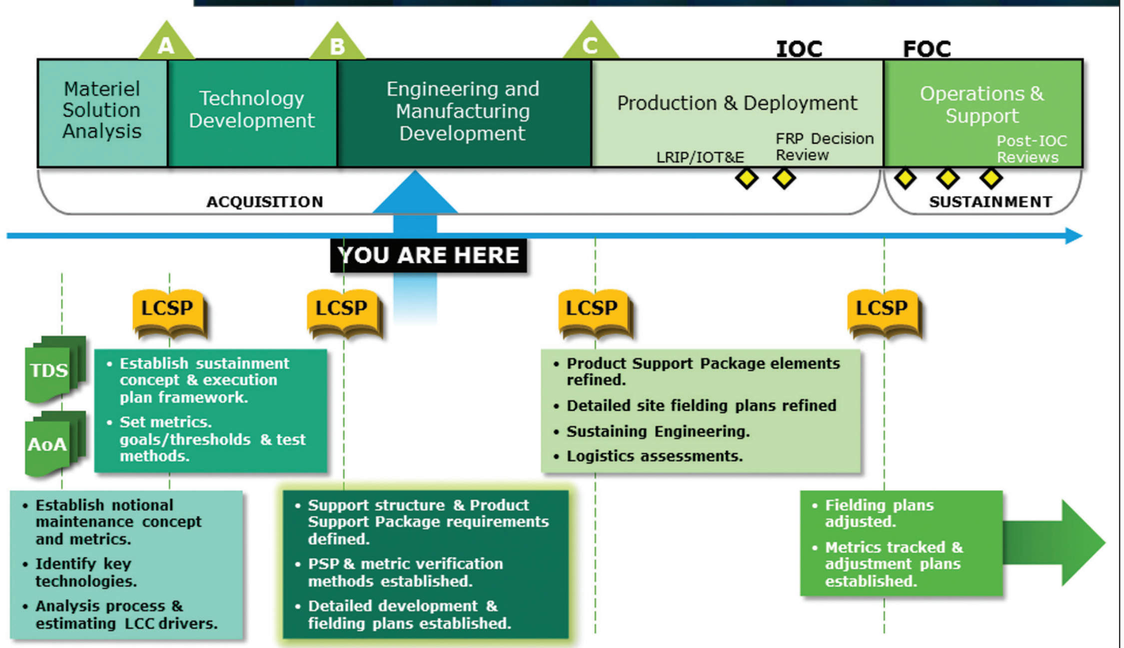
You Are Here ...



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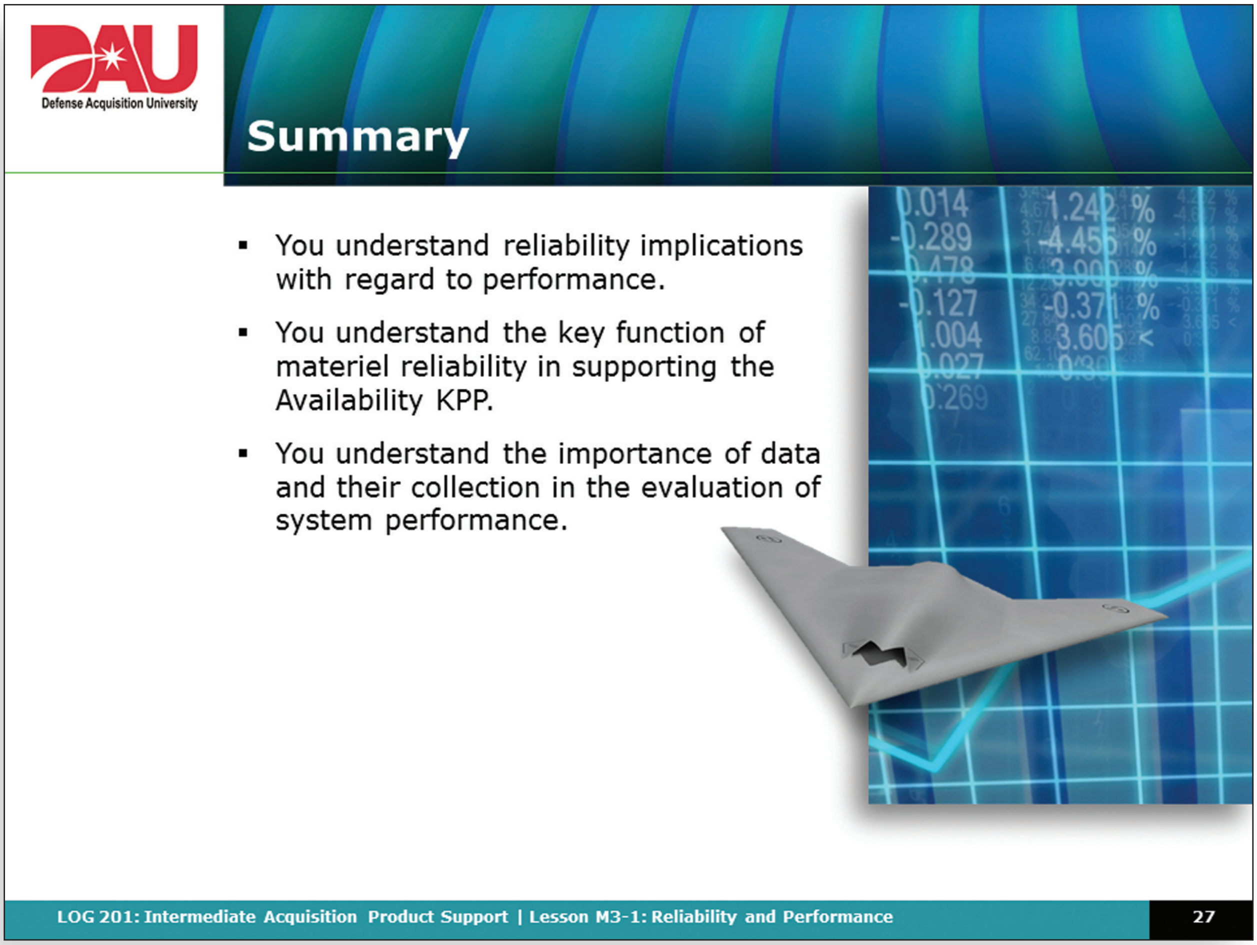
Defense Acquisition University
Summary
▪ You understand reliability implications with regard to performance.
▪ You understand the key function of materiel reliability in supporting the Availability KPP.
▪ You understand the importance of data and their collection in the evaluation of system performance.
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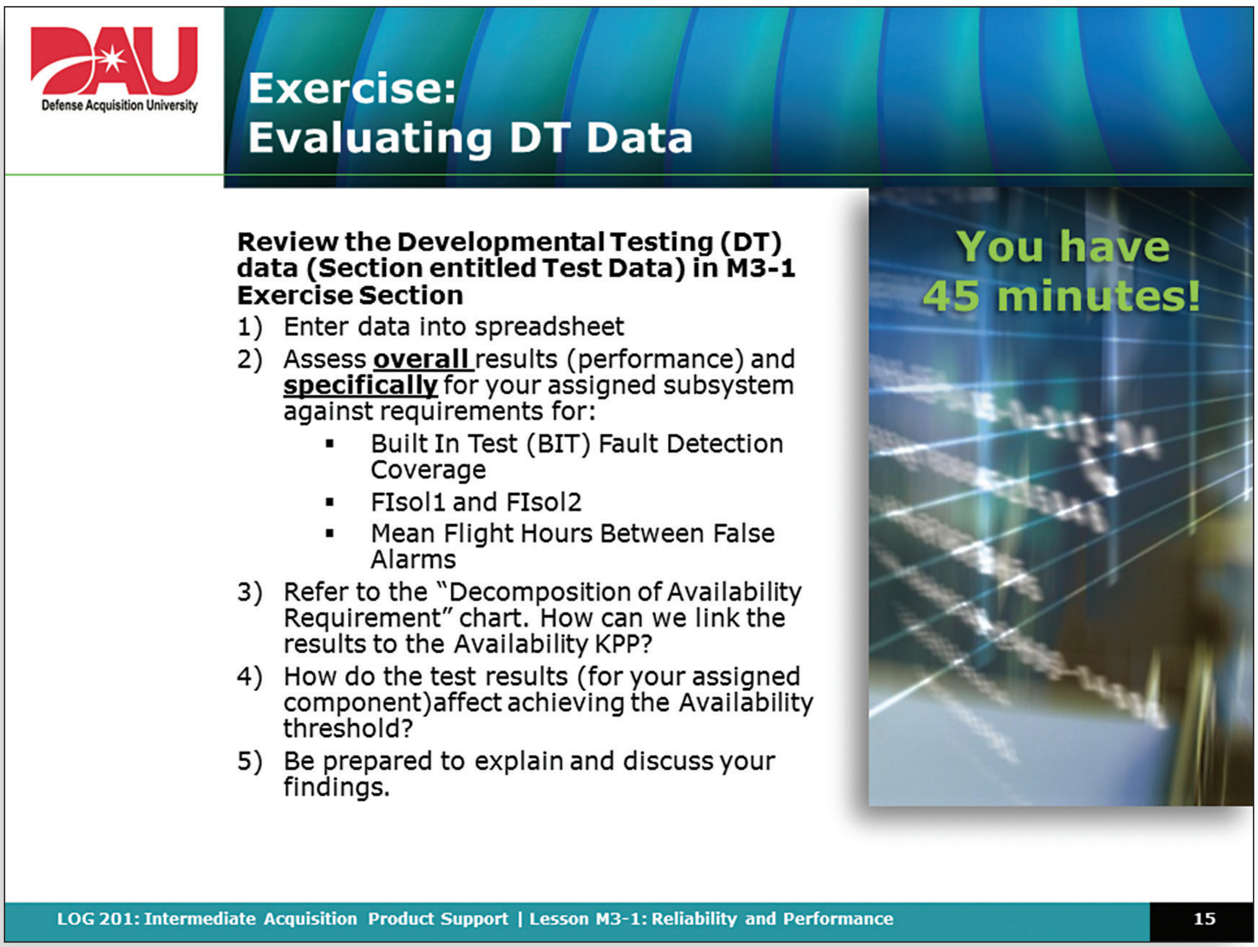
Notes:

Lesson 3-1 Exercise



Team Assignments

Team	Subsystem
Instructor	Engine Life Usage Processor (ELUP)
1	Hydraulic Health Subunit
2	Flight Stress Computer
3	Health Management System (HMS) Signal Processor
4	Data Download System
5	Vehicle Management System

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In this exercise, you will continue as the LCL as part of the team reviewing PHM subsystem DT data and project the impacts on Ao. You will:

1. Assess:

a. Fault Detection Coverage (FDetcov)

b. FIsol1 and FIsol2

c. MFHBFA

2. Determine expected impacts on availability and the associated lower-level metrics.

3. Be prepared to justify your answers.

To assist you in your analysis, you will be provided a spreadsheet that includes the breakdown of the PHM subsystem by WRA. DT test results are discussed below in narrative form **in the section titled "Test Data."** Your task is to fill in a table with appropriate data from DT. Embedded software will process the data and populate a second table for you. This second data table then will reflect the new performance profile for each WRA and the PHM subsystem as a whole. Bear in mind that this second data table automatically will be populated by the first table, and, therefor, is locked, eliminating the need for you to enter any data directly into it.

You and your team will develop a table that compares provided DT data with the requirements published in the EMD contract's PBSS. Also, you and your team will be tasked to identify cost, schedule, performance, and/or supportability risks (in bullet format) associated with any failure to meet the performance specification requirements. The following spreadsheet definitions/descriptions apply:

Number of False Alarms: This is the number of False BIT indications associated with a specific PHM WRA.

Total Number of Faults: This is the total number of faults associated with a specific PHM WRA.

Number of BIT Detectable Faults: This is the total number of faults associated with a specific PHM WRA for which there is a BIT function available to detect.

Fault Detection Rate (Coverage): The total number of BIT detectable failures divided by the total number of failures. This excludes structural and mechanical equipment where the design does not allow for BIT integration. The minimum requirement is 85 percent.

Fault Isolation Rate: The percentage of detected failures for which there was a correct identification of the faulty Weapons Replaceable Assembly(ies) (WRA) either directly or through the use of prescribed maintenance procedures. The Fault Isolation rate is calculated as the total number of failures correctly isolated to a specified WRA ambiguity group divided by the total detected failures (not including false alarms).

BIT Fault Isolation 1 (FIsol1): This is the total number of faults associated with a specific PHM WRA for which the BIT was able to correctly isolate the fault to one specific WRA being monitored.

BIT Fault Isolation 2 (FIsol2): For Strike Talon PHM, this is the total number of faults associated with a specific PHM WRA for which the BIT was able to correctly isolate the fault to two or fewer WRAs being monitored.

Test Data

The Strike Talon has logged 4,750 hours of DT. The Engine Life Usage Processor (ELUP) experienced 150 faults during the test period with 111 BIT detectable failures, 109 Correct Bit Indications, and 3 false alarms. The ELUP also had 64 BIT Isolation 1 and 84 BIT Isolation 2 events.

Seventy-five faults occurred in the Hydraulic Health Sub-Unit, with 50 being BIT detectable faults and 45 Correct Bit Indications; there also were 2 false alarms. The Sub-Unit had 34 BIT Isolation 1 and 43 BIT Isolation 2 occurrences.

The Flight Stress Computer had 199 BIT detectable faults out of 290 total faults. There were 170 Correct Bit Indications. There were 121 BIT Isolation 1 and 129 BIT Isolation 2 occurrences. 2 false alarms were recorded.

The Health Management System (HMS) Signal Processor had 155 total faults with 2 false alarms during the test period. There were 130 BIT detectable faults, with 71 BIT Isolation 1 and 82 BIT Isolation 2 occurrences. Eighty-nine correct Bit Indications were recorded.

Sixty-three total faults were experienced on the Data Download System, with 54 being BIT detectable faults. There were 47 Correct Bit Indications. The DDS had 3 false alarms, 33 BIT Isolation 1, and 37 BIT Isolation 2.

Finally, the Vehicle Management System had 187 BIT detectable faults out of 225 total faults. There were 122 BIT Isolation 1, as well as 122 BIT Isolation 2 occurrences. There also were 3 false alarms and 160 Correct Bit Indications.

Prognostics Health Management System	Planned/ De-rated Values (False Alarm and Detection Rates)	DT Results	Do You Feel Lucky?	What Can We Do?
MFHBFA	T - ≥ 300 hours O - ≥ 2000 hours			
Fault Detection Coverage	≥ 85 percent of all system failures excluding structural and mechanical equipment where the design does not allow for BIT integration.			
Fault Isolation to 2 WRAs	≥85 percent of detected failures to an ambiguity group of one WRA.			
Fault Isolation to 1 WRA	≥90 percent of detected failures to an ambiguity group of two WRAs.			

Reading

"Designing for Supportability—Driving Reliability, Availability and Maintainability In While Driving Costs Out" by Patrick M. Dallosta and Thomas A. Simcik, *Defense AT&L* magazine, March–April 2012.

Designing for Supportability

Driving Reliability, Availability, and Maintainability In...

Patrick M. Dallosta ■ *Thomas A. Simcik*

Weapon systems must provide a needed capability, meet user needs as evidenced by operational effectiveness and operational suitability, and must be affordable. While operational effectiveness addresses the degree of mission accomplishment in the intended environment, operational suitability addresses the degree to which a system can be satisfactorily placed in use, given reliability, availability, maintainability (RAM), supportability, and ownership cost, among other factors. These requirements are tested and quantified prior to fielding by the initial operational test and evaluation (IOT&E) process, and assessed against defined criteria. As illustrated in Figure 1, total ownership costs (TOC) incurred during the operations and support (O&S) phase may constitute 65 percent to 80 percent of total life cycle cost (LCC).

How then do we address the problem of high TOC while still meeting the warfighter's requirements? We do so by focusing on the causes of high TOC in both system design (quality) and logistics footprint (quantity). This includes the application of skills and processes in the areas of RAM, supportability, and supportability analysis as part of the revitalized systems engineering processes required by the 2009 Weapon Systems Acquisition Reform Act (WSARA).

Dallosta *is the performance learning director for reliability, availability, maintainability, and supportability at the DAU Center for Logistics and Sustainment.* **Simcik** *is the performance learning director for life cycle management integration at the DAU Center for Logistics and Sustainment.*

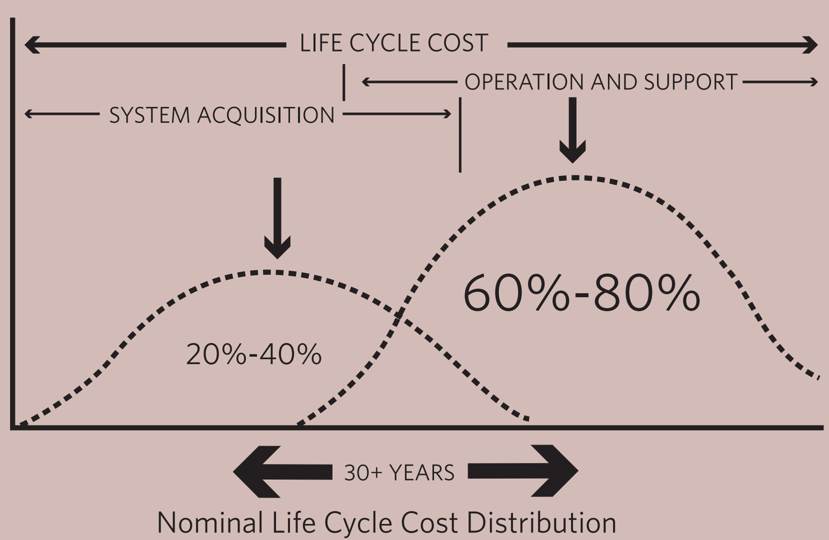
…While Driving Costs Out

Supportability Analysis Framework

Supportability measures the degree to which a system can be supported both in terms of its inherent design characteristics of reliability and maintainability and the efficacy of the various elements of product support, to include the spare parts, tools, and training required to operate and maintain it.

Supportability analysis is a structured methodology to ensure the system is designed for supportability and the product support elements are identified and available to the user. The affordable system operational effectiveness (ASOE) model addresses the contributions of both system design (quality) and logistics footprint (quantity) to total ownership cost.

Figure 1. Life Cycle Cost Distribution



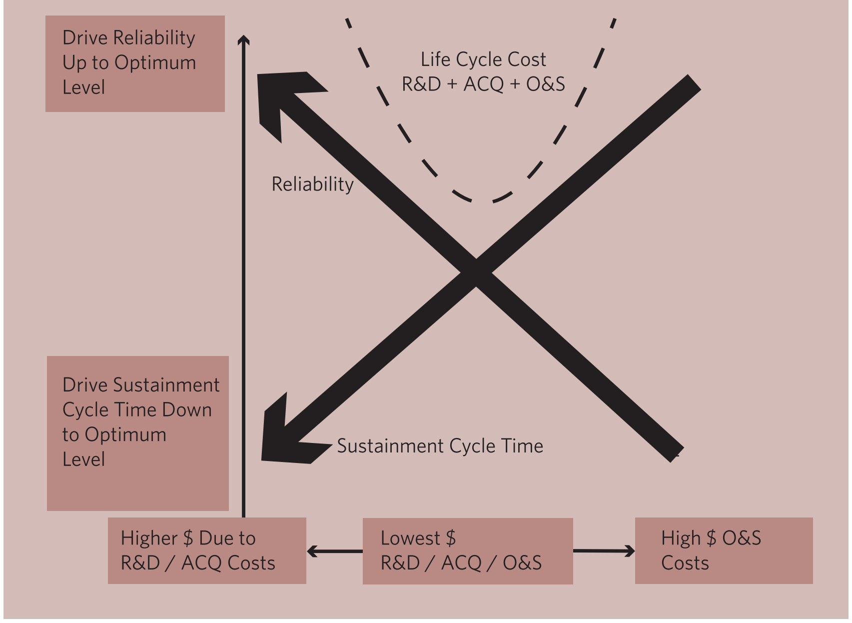


Figure 2. Reliability, Availability, Maintainability—Life Cycle Cost Trade Space

The ASOE model comprises two components. System design for operational effectiveness (SDOE) focuses on the impact of reliability and maintainability as design parameters and their role in meeting operational effectiveness and suitability requirements. The second component, the supply chain model (SCM) focuses on the logistics activities that enable effective sustainment. (A full description is provided in *Designing and Assessing Supportability in DOD Weapon Systems. A Guide to Increased Reliability and Reduced Logistics Footprint*, available at the Acquisition Community Connection website.)

Together, the two models define a RAM/LCC trade space, as illustrated in Figure 2. The trade space bounds the values of reliability and sustainment cycle time to achieve the lowest LCC. The balancing is conducted throughout the life cycle to ensure an optimized solution. While early-phase considerations may exhibit higher R&D and acquisition costs due to the cost of implementing RAM programs, the reduction in O&S costs due to the improved performance and decreased sustainment costs far outweighs implementation costs.

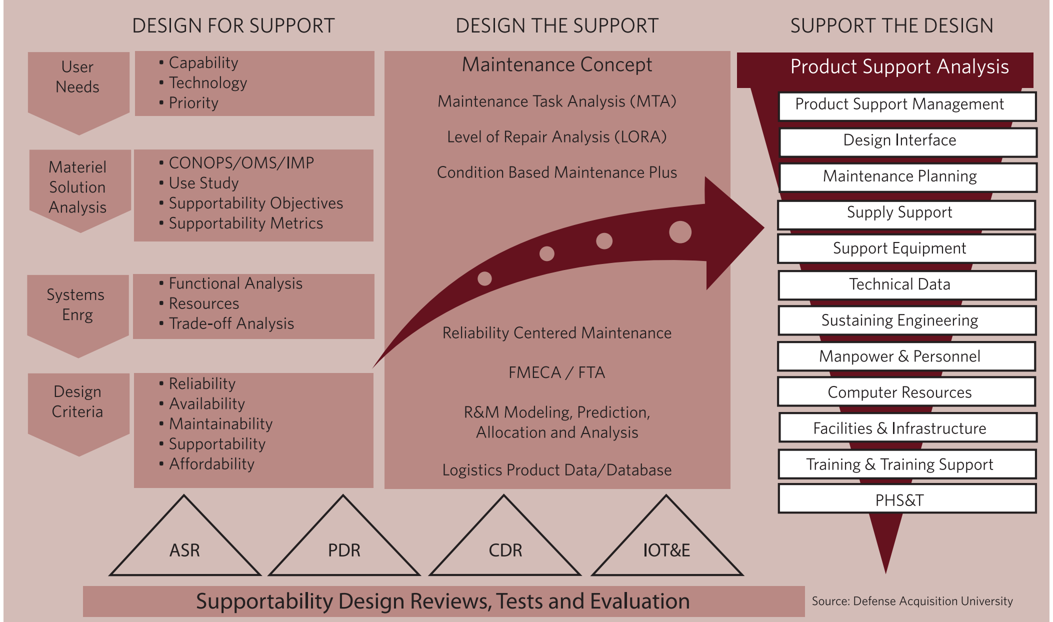
Cumulatively, the models define the supportability and supportability analysis activities conducted collaboratively by the systems engineering and life cycle logistics domains, and provide a powerful and effective means of ensuring life cycle suitability for O&S.

The Supportability Analysis Life Cycle Framework in Figure 3 identifies key supportability analysis activities and their relationships, and serves as the framework for this process. The framework is described in terms of three distinct yet integrated processes.

Design for Support

Decisions made up front during the early phases have a profound effect on life cycle cost. As illustrated in Figure 4, design decisions made by Milestone B establish a "cost commitment" of approximately 70 percent of a system's LCC, while actual

Figure 3. Supportability Analysis Life Cycle Framework



Source: Defense Acquisition University

"cost expended" values are still a small percentage of total expenditures.

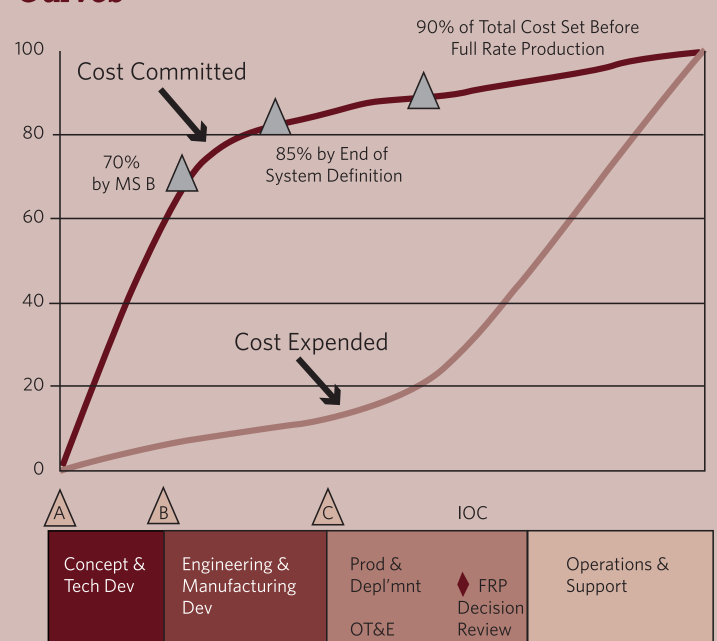
"Design for support" activities begin at the earliest life cycle phase when user needs are identified, capabilities defined, and priorities established. During this phase, supportability objectives, their associated metrics, and the initial trade studies are conducted within the systems engineering/life cycle logistics process and result in the preferred system design and sustainment architectures with specific design criteria.

Key to these activities is the development of the maintenance concept, which specifies the levels of maintenance and their capabilities and assigns the preventive and corrective tasks to be accomplished at each level. The maintenance concept provides the construct by which systems engineering/life cycle logistics tasks are conducted. The tasks include reliability and maintainability (R&M) modeling, prediction, allocation and analysis; failure mode, effects and criticality (FMECA); fault tree analysis (FTA); and condition-based maintenance plus (CBM+), and reliability centered maintenance (RCM).

The output of these tasks is the assessment of the impact of the system's R&M design characteristics on performance and sustainment. Improvements in RAM are achieved by the elimination of single points of failure, improved mean time between failure (MTBF) through the use of redundancy, and the reduction of mean time to repair (MTTR), through the implementation of accessibility, modularity and testability concepts. Overall reductions in maintenance are also achieved by CBM+ and RCM programs that focus on conducting maintenance based on the evidence of need rather than defined schedules.

Overall reductions in maintenance are also achieved by CBM+ and RCM programs that focus on conducting maintenance based on the evidence of need rather than defined schedules.

Figure 4. Cost Committed vs. Cost Expended Curves



From both a cost and logistics perspective, the level of repair analysis (LORA) is the most important business decision made in the program office. The LORA uses the detailed maintenance information provided by the maintenance task analysis (MTA), as well as operational factors and economic criteria to allocate the repair/disposal actions throughout the levels of maintenance, and to provide an LCC estimate for use in decision making. The LORA provides the information needed to finalize the maintenance concept as well as initiate maintenance planning activities.

Design the Support

The "design the support" process is based on the output of the design for support process as described previously—i.e., the spares, common, peculiar, and unique tools and discrete and automatic test equipment, facilities, and maintenance training that must be specified and procured. For example, support equipment recommendation data (SERD) is generated as part of the product support analysis (PSA) process to specify measurement requirements and determine if existing equipment can be used or whether new equipment must be designed and procured. A properly tailored product support package, based on the technical requirements of the system, will yield the most affordable and operationally ready capability.

The DoDI 5000.02 acquisition process includes the preliminary design review (PDR) and the critical design review (CDR) to ensure requirements are defined, traceable throughout the design and that governance evaluates the effectiveness of their implementation and the implications on performance, cost, schedule and sustainment. The DoD systems engineering process uses the defense acquisition program support (DAPS) methodology to review the design and ensure supportability metrics are defined, implemented in the design as criteria, and that the design reflects their impact on the system in meeting performance and sustainment requirements.

DAPS provides the tailorable framework for conducting program reviews to assist program managers and DoD decision makers in preparation for milestone decision reviews. The methodology provides a standardized approach to conduct program reviews, and allows for the participation of a broad cadre of subject matter experts.

Chapter 9 of the *Defense Acquisition Guidebook* addresses the developmental test & evaluation (DT&E) and operational test & evaluation (OT&E) processes as the principal methods of ensuring the achievement of user needs as expressed in key performance parameters (KPPs).

DT&E provides the verification and validation of the systems engineering process and must provide confidence that the system design solution is on track to satisfy the desired capabilities. Rigorous component and sub-system DT&E enables performance capability and reliability improvements to be designed into the system early. DT&E events should advance to robust, system-level and system-of-systems level T&E, to ensure that the system has matured to a point where it can enter production, and ultimately meet operational employment requirements.

OT&E focuses on testing the system in its intended use environment where two primary metrics reign: operational effectiveness and suitability. Operational effectiveness is the overall degree of mission accomplishment of a system when used by representative personnel in the environment planned or expected for operational employment of the system considering organization, doctrine, survivability, tactics, vulnerability, and threat. Operational suitability is the degree to which a system can be satisfactorily placed in field use, with consideration given to reliability, availability, compatibility, transportability, interoperability, wartime usage rates, maintainability, safety, human factors, manpower supportability, logistics supportability, documentation, training requirements, and natural environmental effects and impacts.

From both supportability and supportability analysis perspectives, DT&E and OT&E combine to provide quantitative measurement and qualitative assessment of both performance in terms of reliability and maintainability, and the effectiveness of the product support infrastructure and sustainment resources.

Support the Design

The "support the design" process is implemented through the resources of the Integrated Product Support (IPS) Package, as discussed in Appendix A of the *DoD Product Support Manager Guidebook* and is the ultimate outcome of the supportability analysis process. As shown in Figure 3, the 12 IPS elements are defined as a result of a robust product support analysis and provide the assets required for effective sustainment of the system.

Conclusion

Weapon systems must provide a needed military capability, meet user needs as evidenced by operational effectiveness and operational suitability, and must be affordable. Ensuring affordability starts at the earliest phases of a system's life cycle, where decisions drive acquisition costs and essentially lock in O&S costs. The supportability analysis process provides a tool that can be collaboratively used by the systems engineering and logistics domains to address the impact of the design characteristics of reliability, availability, and maintainability on the system design and the logistics footprint to achieve program outcomes.

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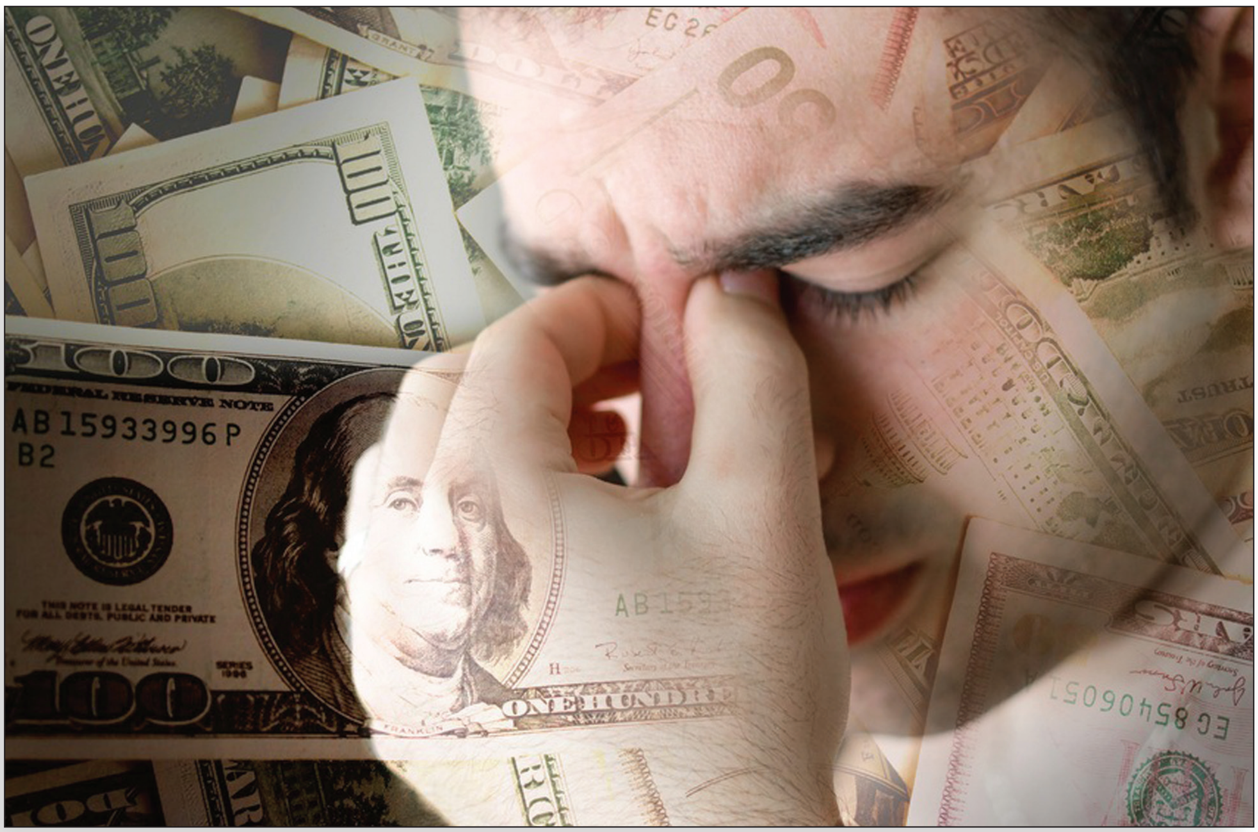
Lesson 3-2

Reliability & Affordability

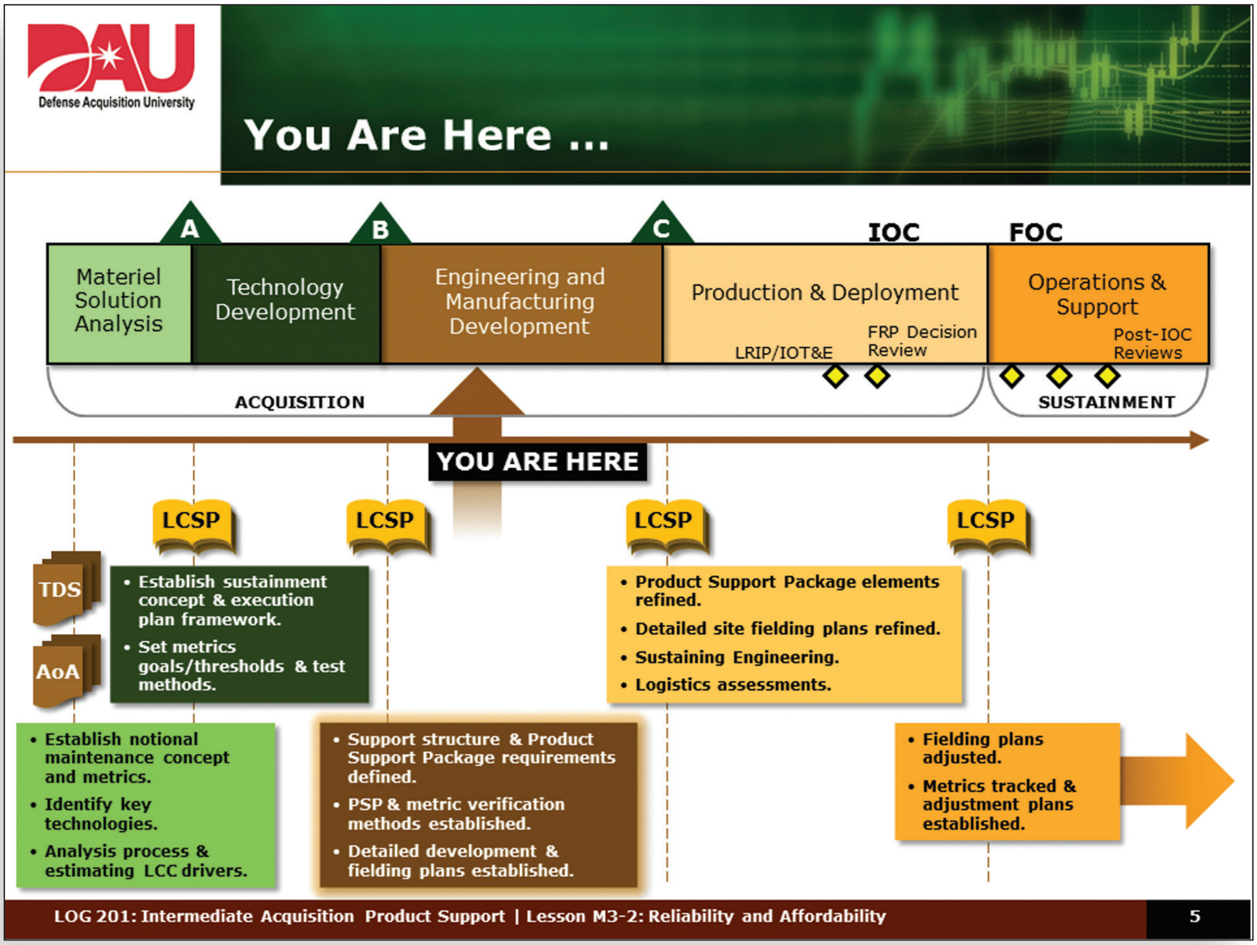


Lesson Objectives:

- Given background information, policies and instruction material, define reliability growth.
- Given program, policy and framework documents, explain the affect of reliability growth on Product Support Planning.
- Given program, policy and framework documents, Integrated Product Support Elements and reliability data, develop courses of action to improve Product Support.
- Given program, policy and framework documents, Integrated Product Support Elements and reliability data, update the Strike Talon Program's LCSP.

What's In It for Me?

- You will understand reliability implications with regard to performance.
- You will understand the key function of materiel reliability in supporting the Availability KPP.
- You will understand the importance of data and its collection in the evaluation of system performance.



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You Are Here ...
A
B
C
IOC
FOC
Materiel Solution Analysis
Technology Development
Engineering and Manufacturing Development
Production & Deployment
LRIP/IOT&E
FRP Decision Review
Operations & Support
Post-IOC Reviews
ACQUISITION
SUSTAINMENT
YOU ARE HERE
LCSP
LCSP
LCSP
LCSP
TDS
AoA
• Establish sustainment concept & execution plan framework.
• Set metrics goals/thresholds & test methods.
• Product Support Package elements refined.
• Detailed site fielding plans refined.
• Sustaining Engineering.
• Logistics assessments.
• Establish notional maintenance concept and metrics.
• Identify key technologies.
• Analysis process & estimating LCC drivers.
• Support structure & Product Support Package requirements defined.
• PSP & metric verification methods established.
• Detailed development & fielding plans established.
• Fielding plans adjusted.
• Metrics tracked & adjustment plans established.
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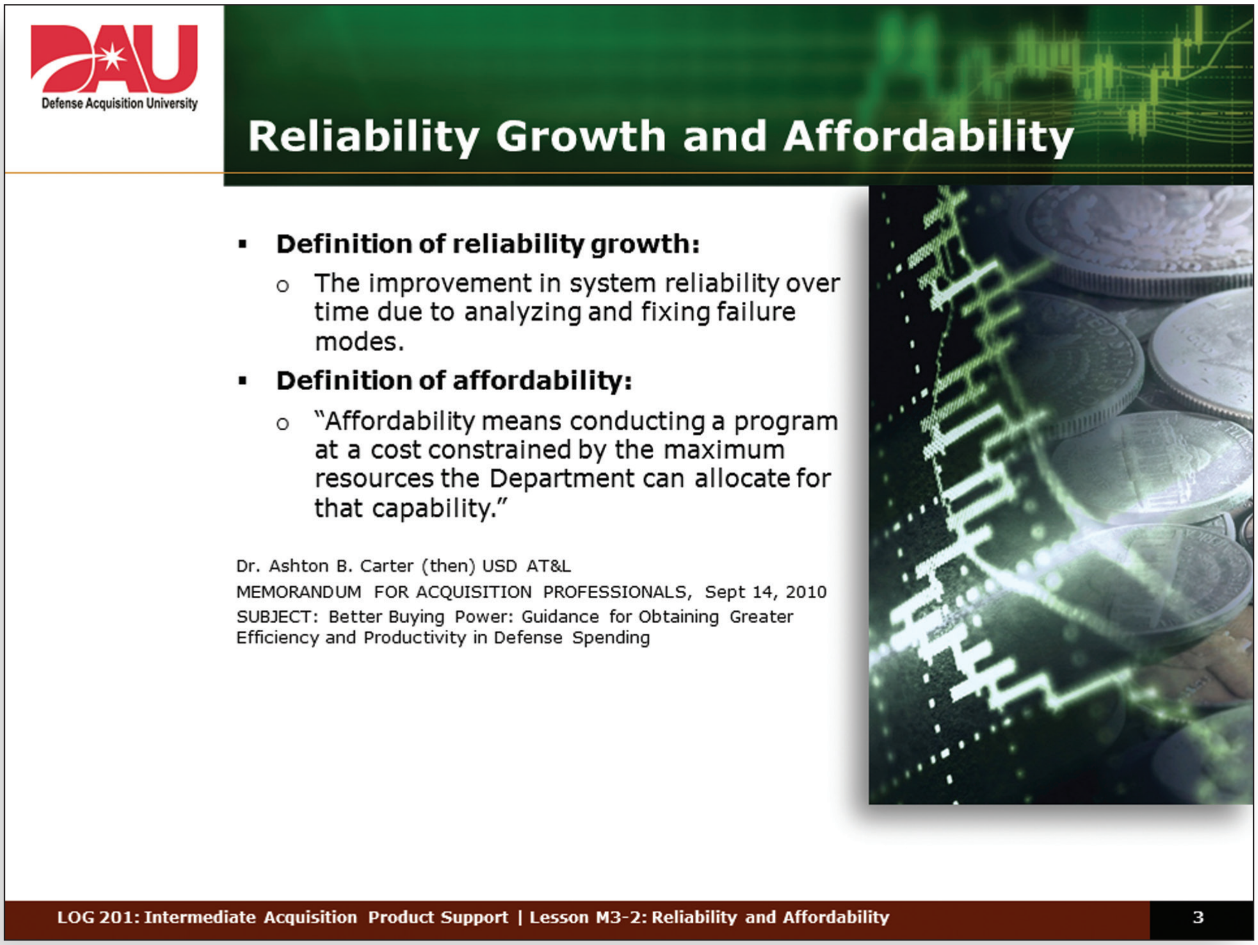
Notes:



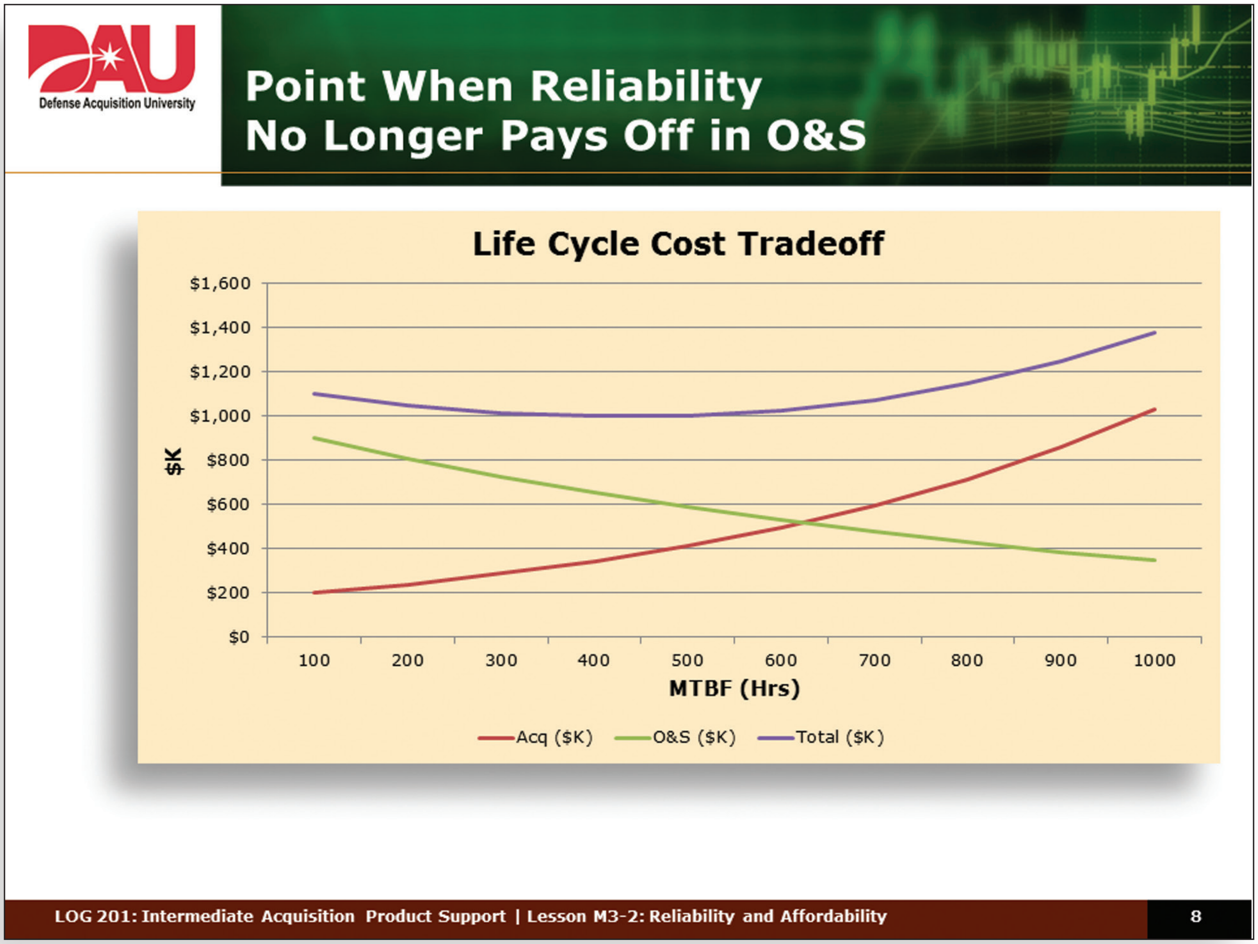
Notes:

Remember the definition of reliability growth. Now we consider the growth's affordability.

Notes:

Some basic questions we need to answer to move forward. This is where we need to conduct business case analyses.

Definition of Business Case Analysis:

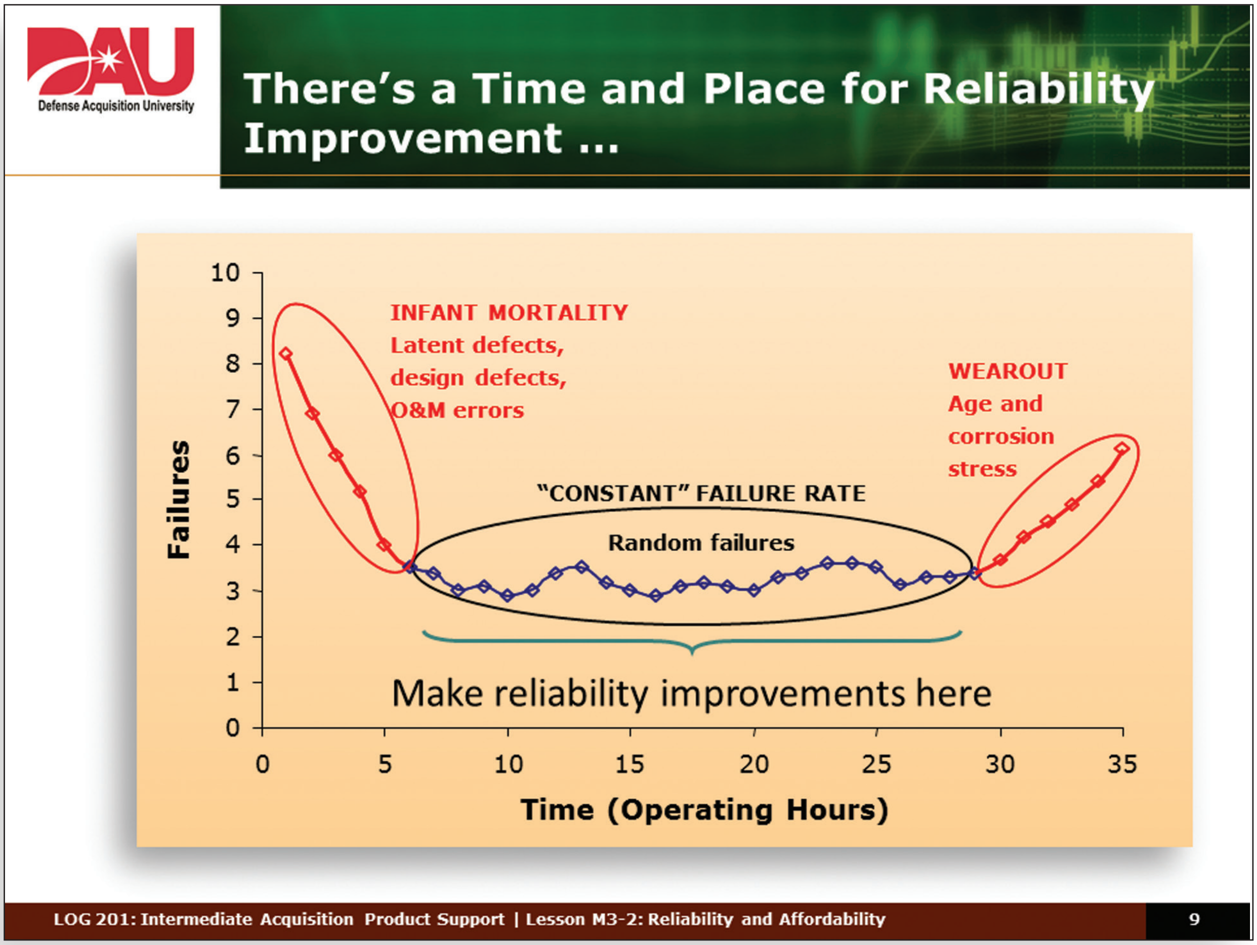


Notes:

If the addition of reliability through modification (such as ECPs and tech refresh) would reimpose dollar for dollar in procurement cost the savings in O&S cost, there would be no point in spending the money (at least from an affordability standpoint).

Why would we see this improved O&S cost? (Think IPS elements.)

But there is a point of diminishing and even losing returns. As you invest more and more into reliability the procurement costs invested starts to outstrip the O&S cost benefits. The challenge is to find the point of least total cost—where the lines intersect.



Notes:

When looking at the so-called "Bathtub Curve," you want to plan your modifications during the constant failure part of the life cycle. With the right materials (burn in already completed—using Market Research and possibly COTS?), you will bring new items in after they've passed through "infant mortality." You then want to time the modification, engineering change or tech refresh so it is in place just prior to "wear out."

So, How Do We Evaluate Affordability?

- Investing now in reliability can save money in the future.
- What methods do we have to forecast the affordability of a system?
- What are the components of an O&S cost estimate?
- Who does it?
- Why do we care?

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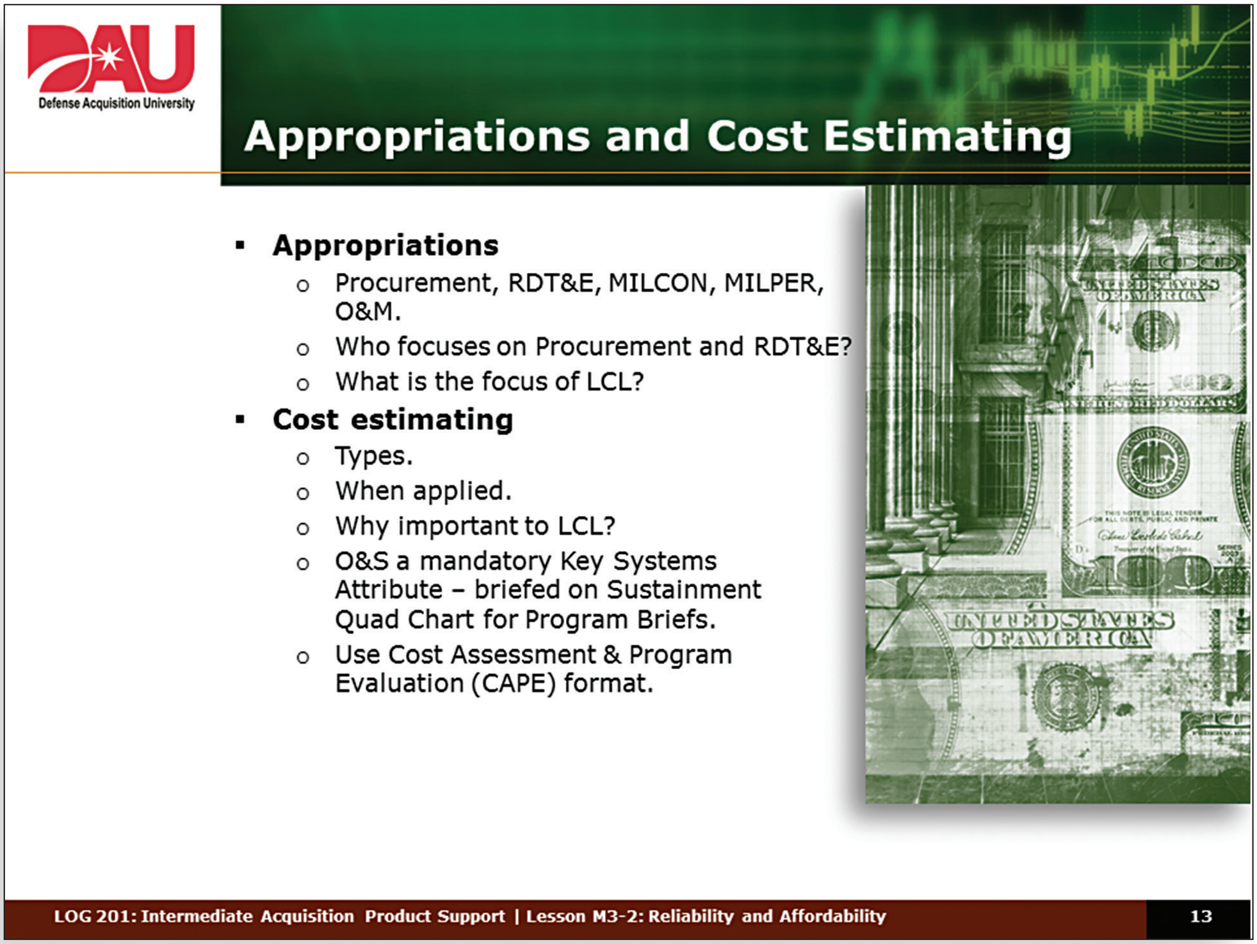
Notes:

Student Exercise 1. (See Exercise Section for instructions.)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Appropriations and Cost Estimating
Appropriations
Procurement, RDT&E, MILCON, MILPER, O&M.
Who focuses on Procurement and RDT&E?
What is the focus of LCL?
Cost estimating
Types.
When applied.
Why important to LCL?
O&S a mandatory Key Systems Attribute – briefed on Sustainment Quad Chart for Program Briefs.
Use Cost Assessment & Program Evaluation (CAPE) format.
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Notes:

CAPE O&S Categories and Appropriations

Appropriations	Unit Personnel	Unit Operations	Maintenance	Sustaining Support	Continuing Support	Indirect Support
MILPER	Military Personnel in Operating Units		Military personnel in Intermediate or Depot Maintenance Units	Replacement Training	Simulator Operations	Base Operations
O&M	Civilians and Contractors working in Units	Fuel, purchased services, TDY/TAD	Consumable Supplies, Depot Level Repairables, Civilians, Contractors, Contract Services, Transportation	Replacement Training	Simulator Operations	Base Operations, Medical
Procurement		Training Ammo, Rockets, Bombs, Missiles		Replacement Support Equipment	Modification Kit Production	Base Operations
RDT&E					Software Updates, New subsystem	
MILCON						Base Operations

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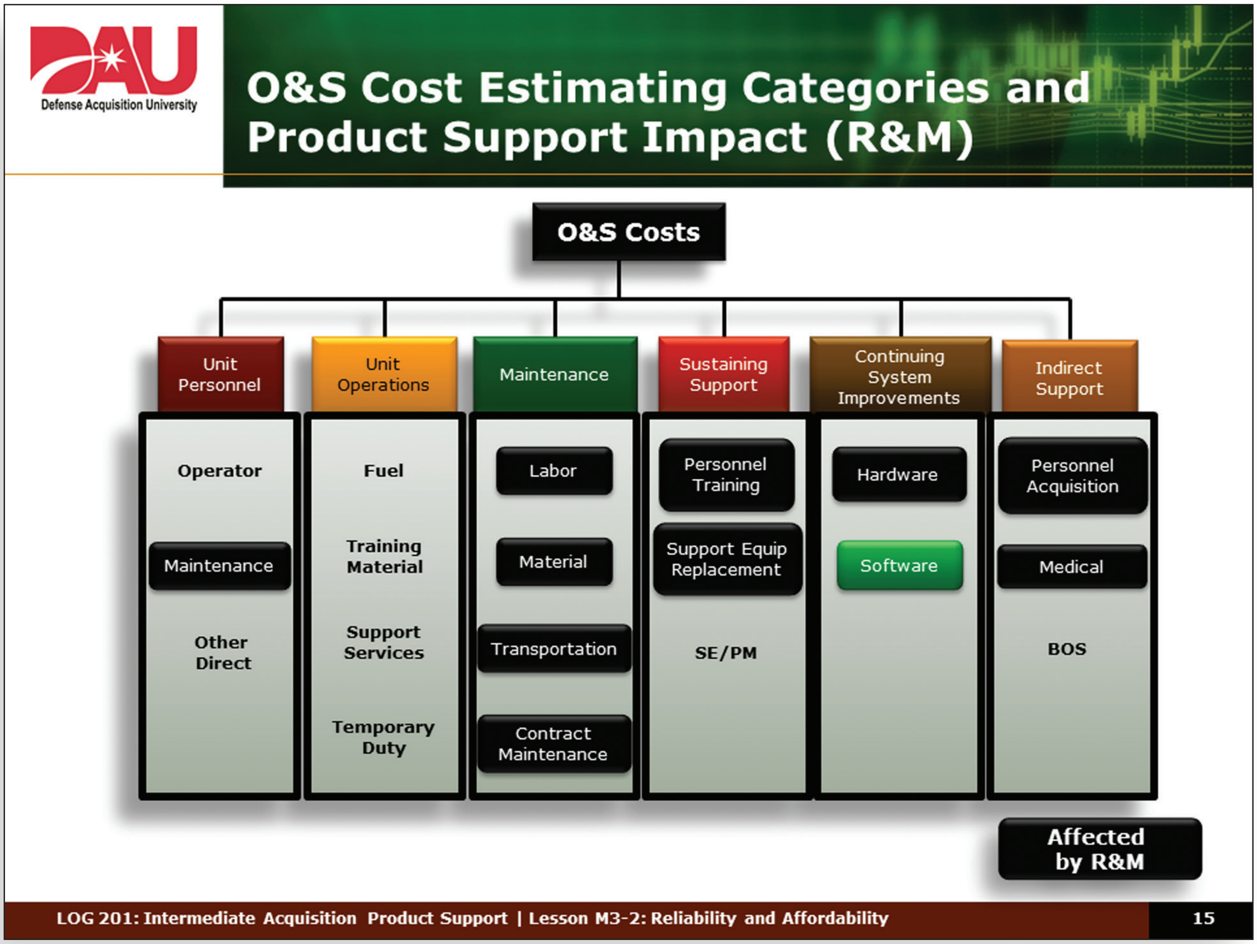
Notes:

Operations and Support does not equal Operations and Maintenance appropriation!!


O&S Cost Estimating Categories and Product Support Impact (R&M)
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O&S Costs
Unit Personnel
Unit Operations
Maintenance
Sustaining Support
Continuing System Improvements
Indirect Support
Operator
Maintenance
Other Direct
Fuel
Training Material
Support Services
Temporary Duty
Labor
Material
Transportation
Contract Maintenance
Personnel Training
Support Equip Replacement
SE/PM
Hardware
Software
Personnel Acquisition
Medical
BOS
Affected by R&M
LOG 201: Intermediate Acquisition Product Support | Lesson M3-2: Reliability and Affordability
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Notes:

So Why Do We Care?

- **Sustainment Quad Chart—requirement at decision briefings**
- **Includes**
  - Product Support Status
  - Product Support Schedule
  - Four Logistics and Material Readiness Metrics
  - O&S Cost Estimates
- **Focus of Tomorrow Morning's Exercise**

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Notes:

Life Cycle Sustainment Plan Outline

SECTIONS

1 Introduction
2 Product Support Performance
3 Product Support Strategy
4 Product Support Arrangements
5 Product Support Package Status
6 Regulatory/Statutory Requirements That Influence Sustainment Performance
7 Integrated Schedule
8 Funding
9 Management
10 Supportability Analysis
11 Additional Sustainment Planning Factors
12 LCSP Annexes

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What Do We Put in the Annexes? Some Examples …

Logistics Demonstrations (LOG Demos) Plans

Used to:

- Evaluate the adequacy of the System Support Package (SSP).
- Ensure that the gaining unit has the logistical capability to achieve initial operational capability (IOC).

Part of Logistics Test and Evaluation

- Specific evaluations for logistics
- May also include the subset of maintenance demos

Fielding Plans

- Serve as the single stand-alone document for …
- Detailed plans and actions needed to successfully field and deploy the new system (or new major mod)

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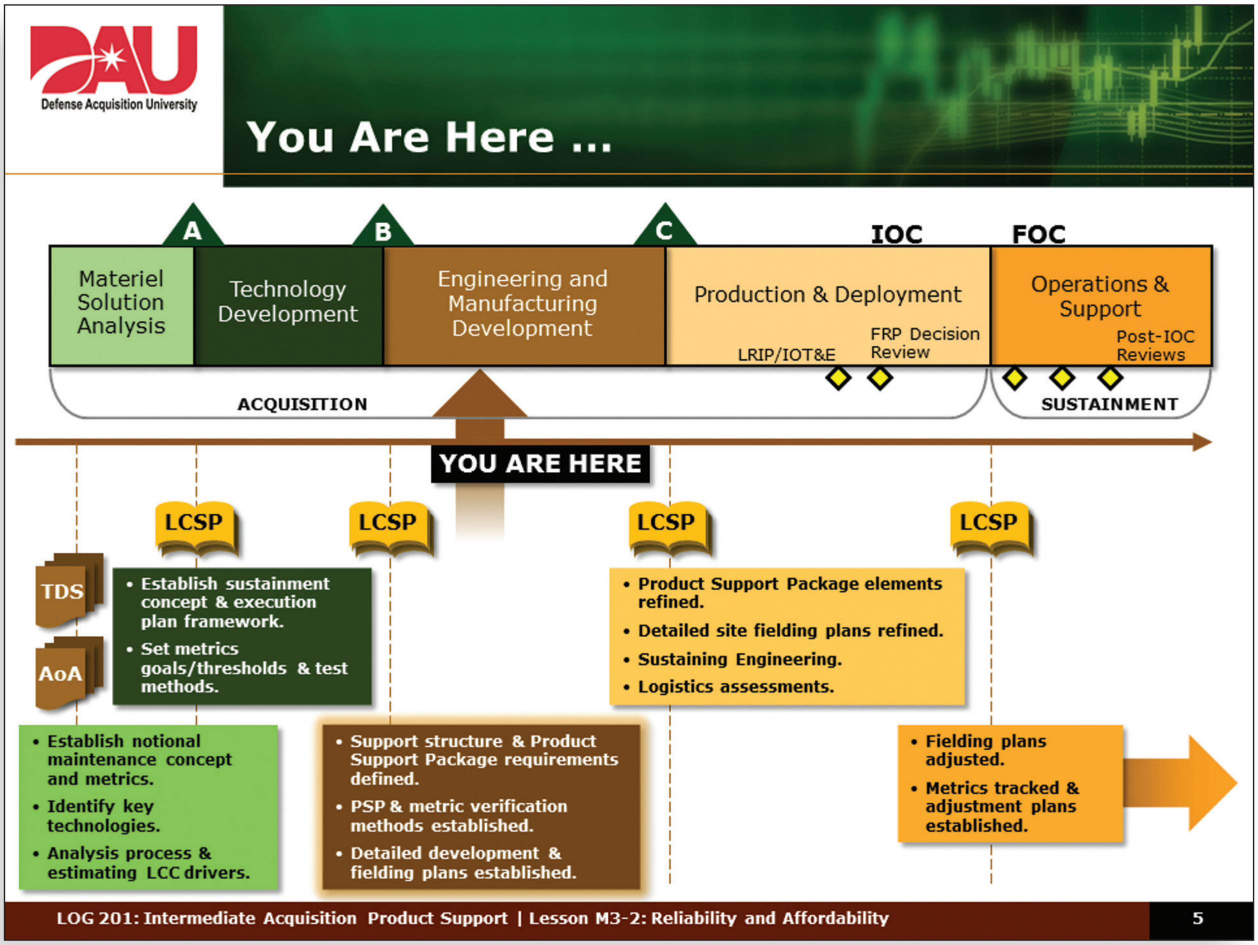

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You Are Here ...
A
B
C
IOC
FOC
Materiel Solution Analysis
Technology Development
Engineering and Manufacturing Development
Production & Deployment
LRIP/IOT&E
FRP Decision Review
Operations & Support
Post-IOC Reviews
ACQUISITION
SUSTAINMENT
YOU ARE HERE
LCSP
LCSP
LCSP
LCSP
TDS
AoA
• Establish sustainment concept & execution plan framework.
• Set metrics goals/thresholds & test methods.
• Product Support Package elements refined.
• Detailed site fielding plans refined.
• Sustaining Engineering.
• Logistics assessments.
• Establish notional maintenance concept and metrics.
• Identify key technologies.
• Analysis process & estimating LCC drivers.
• Support structure & Product Support Package requirements defined.
• PSP & metric verification methods established.
• Detailed development & fielding plans established.
• Fielding plans adjusted.
• Metrics tracked & adjustment plans established.
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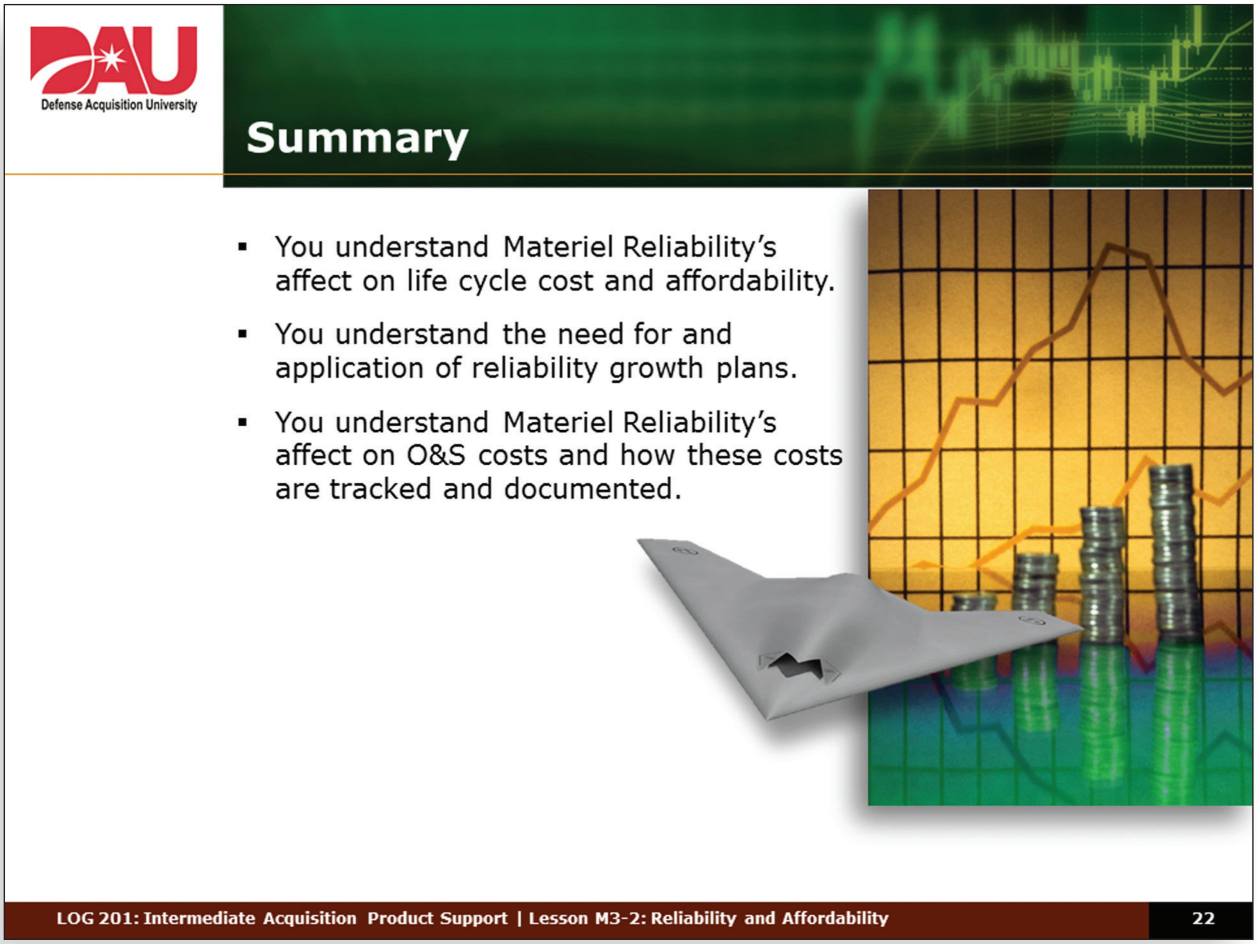
5

Notes: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Summary
You understand Materiel Reliability's affect on life cycle cost and affordability.
You understand the need for and application of reliability growth plans.
You understand Materiel Reliability's affect on O&S costs and how these costs are tracked and documented.
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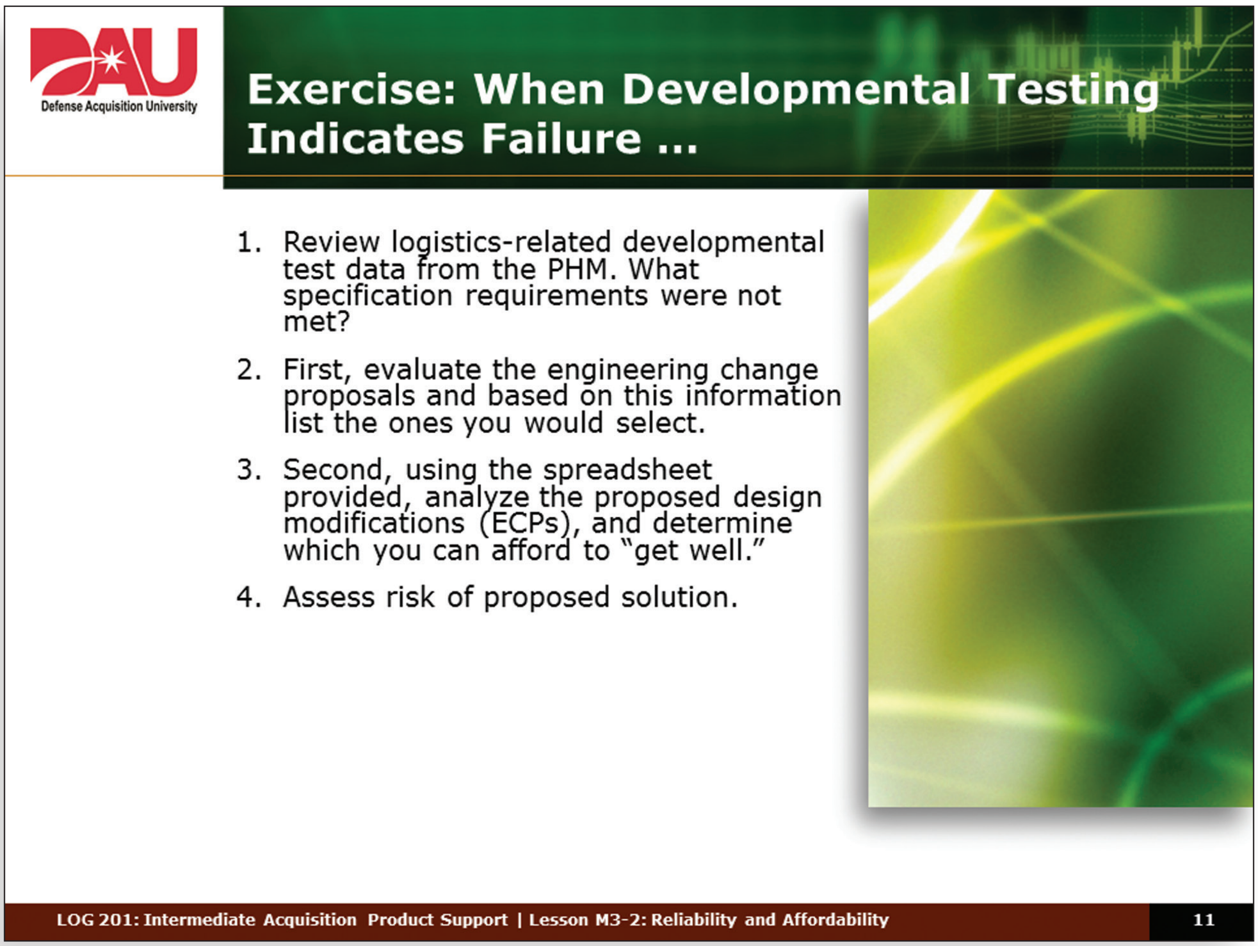
Notes:

Lesson 3-2 Exercises



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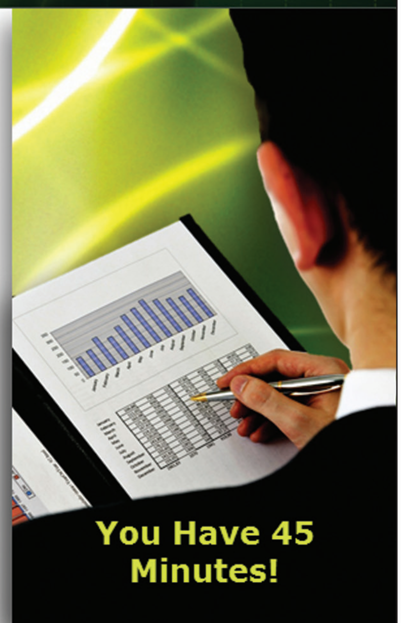
Exercise (p.2): When Developmental Testing Indicates Failure ...

5. Evaluate the improvement in A_i for the PHM system—target is 90 percent
6. Budget targets are:
   a. Procurement—$55 million.
   b. Repair and nonrecurring costs—$170 million.
   c. Field/ Fleet Cost—$35 million.
   d. Field/ Fleet Logistics Footprint Cost—$10 million.
7. Evaluate trades for affordability.
8. How does this affect your O&S cost estimate?



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Notes:

Reading

"OK, We Bought This Thing, but Can We Afford to Operate and Sustain It?" by Mike Taylor and Joseph "Colt" Murphy, *Defense AT&L* magazine, March–April 2012.

OK, We Bought This Thing, but Can We Afford to Operate and Sustain It?

Mike Taylor ■ Joseph "Colt" Murphy

U.S. Air Force photo by Airman 1st Class Tony Ritter

Can affordability of weapon systems acquisitions be achieved without considering operations and support (O&S) costs? The answer is a resounding "No!" With pressures to reduce costs driving DoD's continuous review of programs, business practices, modernization programs, civilian and military personnel levels, overhead costs, and more, leaders at DoD will not only focus on new weapon system procurements, but also the modernization and sustainment of current weapon systems. All DoD programs must strike a balance between requirements and total life cycle costs.

So what do we need to consider regarding the total life cycle costs of a program? And why is it so important?

Taylor, *a professor of cost, contracting, and logistics at DAU, has worked for more than 25 years in acquisition, financial, and logistics fields supporting weapon systems, including over 22 years in the U.S. Navy.* **Murphy**, *a senior financial analyst with the Office of Materiel Readiness, has worked for more than 12 years in various fields spanning fighter aircraft, operational test, and business and economic analyses. He served in the U.S. Air Force for over 8 years.*

When you buy a new car, you not only have to worry about the purchase price, but also the costs of any additional warranties, fuel, maintenance (parts and labor), insurance, taxes, cleaning, etc. You have to ask yourself, "Can I afford to not only buy a new car, but can I afford to own a new car?" That is, you need to consider the total life cycle costs involved in buying and operating the car.

The Beginning and End of O&S Costs

What are O&S costs? When do they begin, and when do they end? According to the 2007 *Operating and Support Cost Estimating Guide*, published by the Cost Analysis Improvement Group (CAIG), now part of the Cost Assessment and Program Evaluation (CAPE), O&S costs consist of sustainment costs incurred from the initial system deployment through the end of the system operations (operating, maintaining, and supporting). This includes the costs of personnel, equipment supplies, software, and services associated with operating, modifying, maintaining, supplying training and supporting the system in the DoD inventory. This may include interim contractor support when it is outside the scope of the production program and the acquisition baseline. O&S costs include costs directly and indirectly attributable to specific programs—i.e., costs that would not occur if the program did not exist, regardless of funding source or management control.

Although there can be different interpretations of this definition based on the acquisition strategy, O&S costs typically start when the first end-item is delivered to DoD or when the first "operational unit" is delivered. On the other hand, the end of the O&S phase may also be defined as the decommissioning or striking from official inventory records of one end item or an operational unit. Each program should address what defines the beginning and the end of the O&S phase in order to address the many costs that should be budgeted throughout the operational life of the weapon system's program.

Looking for All Costs in All the Wrong Phases

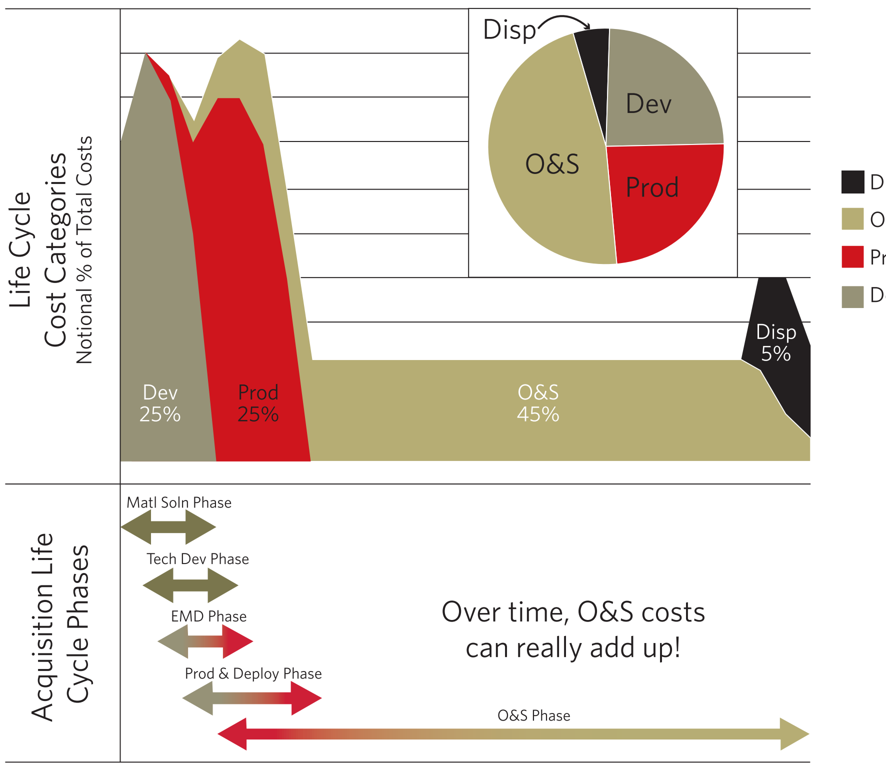
A weapon system's full life cycle is often described by either four major life cycle cost categories or in five phases. The four major cost categories are development, production and deployment, operation and support, and disposal. These terms may be confused with the five phases of the acquisition life cycle. The DODI 5000.02 describes the acquisition cycle phases to include materiel solution analysis, technology development, engineering and manufacturing development (EMD), production and deployment phase, and finally operations and support phase, to include demilitarization and disposal.

Figure 1 shows the life cycle cost categories and the five phases as modified to reflect the changes as put forth in the DODI 5000.02. Of note, this graphic illustrates that O&S costs tend to be a large part of the life cycle cost. Depending on the type program and how long a program may be in service as well as other factors, O&S costs can reach as high as 60 percent–80 percent of the life cycle costs of a weapon system. With this in mind, we can see that since O&S costs can be a large part of DoD programs, especially if the O&S phase is extended, these costs cannot be ignored in considering a total systems approach to understanding total life cycle costs.

O&S: Not My Job!

DoDI 5000.02 states: "The purpose of the Operations and Support Phase is to execute a support program that meets materiel readiness and operational support performance re-

Figure 1. Weapon System Life Cycle Cost Categories and Phases



quirements, and sustains the system in the most cost-effective manner over its total life cycle. Planning for this phase shall begin prior to program initiation and shall be documented in the [life cycle sustainment plan]."

The current Better Buying Power Initiatives' focus is on "should cost" and "affordability as a requirement" early in a program's life cycle before EMD and production. In doing so, these initiatives address affordability by driving design trades and choices based on projected budgets for the product over its life cycle, which, by the way… includes sustainment. This total systems approach is also dictated in the DoD Directive 5000.01 which states that planning for O&S and the estimation of total ownership costs shall begin as early as possible. It is during the design phase that the pressures of weapon systems management prevail to accelerate initial systems procurement, sometimes at the expense of product support planning. These pressures to deliver the best performance possible at the optimum schedule and lowest costs are real in any program.

Historically, program offices and by extension, their contractors, are much more focused and incentivized toward design and procurement of weapon systems. Given this focus earlier in the life cycle, funding efforts are often centered on two appropriation categories: research, development, test and evaluation (RDT&E) and procurement (PROC) appropriations. Single-minded focus on these earlier phases and impacts to program appropriation budgets may increase the sustainment costs of the weapon system over its lifetime. Indeed, the force of statute is felt more in procurement costs and the larger category of program acquisition costs with program cost or schedule parameters for not only major defense acquisition programs (MDAPs) but also for acquisition category (ACAT) II and III programs. If specific parameters are not met, then a program breach may require documentation and reporting in selective acquisition reports (SARs), unit cost reports (UCRs), or acquisition program baselines (APBs). So what requirements, if any, should program offices focus on in order to achieve a balanced approach to reduce total ownership costs, and not just development and production costs?

To address a more balanced systems approach to acquisitions, the key system attribute (KSA) of ownership costs is now required for all acquisitions, in accordance with the Joint Capability Integration and Development System, or JCIDS (CJCSM 3170.01). The ownership cost KSA provides balance to the sustainment solution by ensuring that O&S costs are considered in making decisions. Unfortunately, visibility of sustainment costs is often delayed until the O&S phase where sustainment costs add significantly to the weapon system's total ownership costs.

Furthermore, these out-year costs reflect a myriad of decisions from different organizations at different levels, making modeling and predictability a challenge, especially considering increasing complexity of the weapon systems of the future. Additionally, these costs are borne and managed by operational commands and typically funded mainly through non-program office O&M appropriations, bringing to mind the old adage about "other people's money"! Clearly, it is not only a PSM's concern, nor should it be compartmented as an operational commander's or operational logistician's problem. At the risk of overemphasizing the team effort, it remains the PM's responsibility to balance requirements, schedule and costs to reduce total ownership costs throughout the acquisition process.

How Do I Account for O&S Costs?

The cost element structure (CES) on the operation and sustainment of a weapon system is focused into six major categories. The 2007 *Operating and Support Cost Estimating Guide* (*O&S Guidebook*) provides the CES cost elements and the structure required when performing an O&S cost estimate. The CES elements and costs included in each element are as follows:

- **Unit-Level Manpower:** Costs of operators, maintenance and other support manpower assigned to operating units. May include military, civilian or contractor support.
- **Unit Operations:** Costs of unit material (e.g., fuel and training material, unit support services and unit travel. This excludes all maintenance and repair material.
- **Maintenance:** Cost of all maintenance other than maintenance manpower assigned to operating units. May include contractor maintenance.
- **Sustaining Support:** Cost of support activities other than maintenance that can be attributed to a system and are provided by organizations other than operating units.
- **Continuing system improvements:** Cost of hardware and software modifications to keep the system operating and operationally current.
- **Indirect Support:** Costs of support activities that provide general services that cannot be directly attributed to a system. Indirect support is generally provided by centrally managed activities that provide a wide range of activities.

A simple way of thinking of the CES structure is to ask, "What are the costs associated with operating and sustaining a weapon system?" Often these costs are more difficult to define, scope, and project than most program offices first realize. To help, the *O&S Guidebook* also details other considerations in life cycle costs, O&S cost information, and more information on the O&S cost estimating process, procedures, and sample formats.

We now need to account for O&S costs. This is where many people get confused on categorizing O&S costs—especially with respect to appropriation categories or in more detailed terms, program elements (PEs). It is a common mistake to say that only the O&M appropriation is used in O&S cost estimates. It is impractical to list all the possibilities that may arise in determining what appropriation categories should be included in O&S costs; however, there may be several different appropriations involved.

How Can I Ensure I Have Accounted For All Costs?

Many PSMs speak sustainment support in terms of the IPS Elements for supporting programs. These elements can all factor into O&S costs. The 12 IPS elements as outlined in the DoD *Product Support Manager (PSM) Guidebook* are:

- Product Support Management
- Design Interface
- Sustaining Engineering
- Supply Support
- Maintenance Planning and Management
- Package, Handling, Storage and Transportation (PHS&T)
- Technical Data
- Support Equipment
- Training and Training Support
- Manpower and Personnel
- Facilities and Infrastructure
- Computer Resources

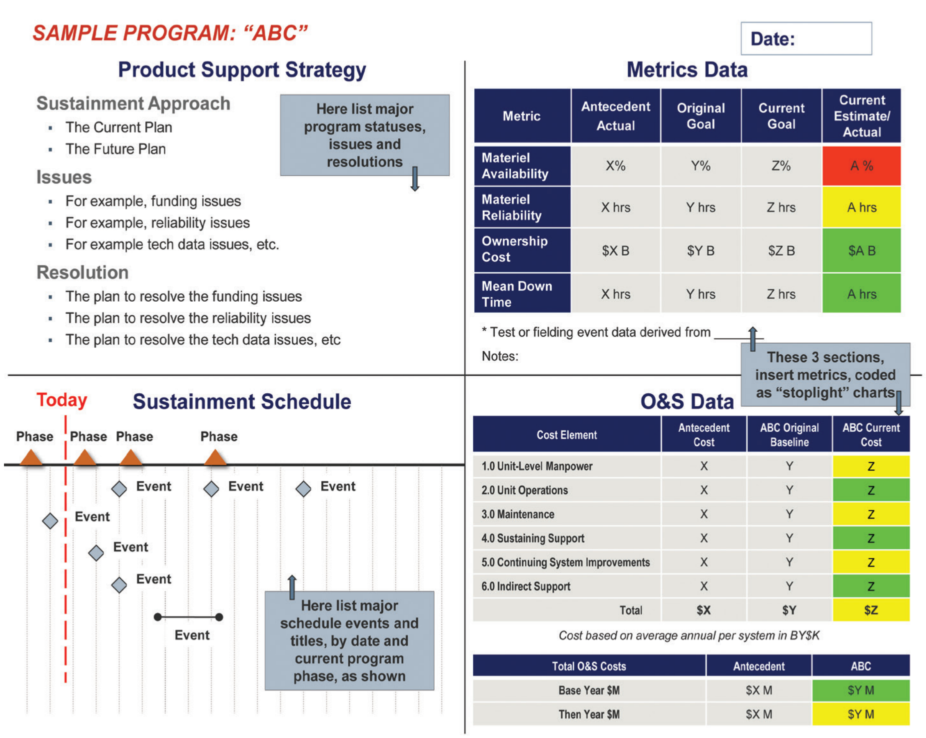
On the other hand, many programmers and budgeters speak in terms of appropriations and/or program elements (PEs). They are concerned about ensuring that program offices properly translated the IPS elements or CES elements into the proper budget submission, or PE elements. So the question arises: "How do I ensure I have translated all my requirements into a proper budget to pay for the O&S costs?"

To help logisticians and cost and budget personnel avoid confusion in categorizing IPS elements, cost elements, and budgeting PEs, a new tool called the "Rosetta stone" is being developed by the Office of the Deputy Assistant Secretary for Defense Materiel Readiness (ODASD [MR]) in conjunction with the CAPE and the Office of the Under Secretary of Defense, Comptroller (OUSD[C]). This tool will help PMs, PSMs, cost estimators, budgeters, and programmers, etc., to ensure that O&S costs are captured, properly categorized, and accounted for in their budget submissions. It will provide a cross-walk to help avoid double counting or omissions of costs to a program across IPS elements, cost elements and PEs.

How Are O&S Cost Estimates Reported in Major Defense Acquisition Programs?

Senior DoD leadership uses meetings such as the Defense Acquisition Board (DAB), defense acquisition executive summaries (DAEs) reviews and overarching integrated product teams (OIPTs) to address life cycle sustainment and management decisions. Currently, there are several different charts used to convey O&S costs. First, the Program Funding and Quantities Chart illuminates the resourcing levels of a program within the context of the full program review. Second, the "Sand Charts" show Operation and Maintenance funding requirements in specific Then Year dollars (TY$) for similar portfolio programs. This paints an easy to interpret

Figure 2. Sample Sustainment Quad Chart



picture of affordability projections within a mission type or Service portfolio.

Finally, the new "sustainment quad chart," required for ACAT 1D programs, summarizes four areas of a program. (See Figure 2.) As stated by the former under secretary of Defense for acquisition, technology and logistics, "Increasing visibility of sustainment factors is vital to ensuring we deliver a program that meets warfighters' materiel readiness objectives with long-term affordability consideration." With this in mind, the sustainment quad chart addresses these issues. The first quadrant is a narrative of the product support strategy approach, list of challenges, and discussion of solutions to those challenges. The second quadrant contains a collection of sustainment KPPs and KSA metrics: materiel availability; materiel reliability, O&S costs (previously ownership costs), and mean down time. The third quadrant of the chart describes an abbreviated sustainment schedule. Finally, the fourth quadrant reviews the total O&S cost data, baselines, and antecedent system data (when available) using the CAPE's CES structure.

These briefing formats are required for all MDAP presentations to the DAB. These tools are being used and are undergoing further refinement to present O&S cost information to senior managers with the goal of making better decisions in acquisition programs.

Where Can I Go for Help in Performing an O&S Cost Estimate?

First of all, the CAIG (now CAPE) has published the *Operating and Support Cost-Estimating Guide* and is working to publish a new *O&S Guide* in the near future to assist program offices in developing an O&S cost estimate. Additionally, ODASD (M&R) is also developing a new *Operating and Support Cost Management Guidebook* intended to supplement the CAPE's guidebook and to assist program office staff in understanding O&S cost estimating and reporting requirements.

Furthermore, Service cost agencies, program offices, and major command cost departments have personnel experienced in producing O&S cost estimates. Never underestimate the value of asking people with this expertise to assist you. Remember, no one works an issue of this importance or complexity in isolation.

Additionally, there are O&S cost data repositories that collect actual cost and non cost data from the services in vast informational databases that can assist PSMs, cost estimators, etc. in developing a O&S cost estimate. The organizations responsible for this data not only collect data from a many sources, they review and scrub the information for accuracy and provide standard and user-defined formats and reports. O&S data can be obtained from the following three major agencies:

- **U.S. Navy and U.S. Marine Corps:** Visibility and Management of Operating and Support Costs (VAMOSC): http://www.vamosc.navy.mil. VAMOSC help desk e-mail: support@vamosc.navy.mil
- **U.S. Army:** Operating and Support Management Information System (OSMIS): https://www.osmisweb.army.mil. OSMIS help desk e-mail: osmisweb@calibresys.com
- **U.S. Air Force:** Air Force Total Ownership Cost (AFTOC):https://aftoc.hill.af.mil/. AFTOC help desk e-mail: SMXG.AFTOC.helpdesk@hill.af.mil

Another excellent resource is provided by DAU: a 1-week training course on O&S costing analysis (course BCF 215), where students learn the basics of conducting an O&S cost estimate.

O&S Costs are Everybody's Business

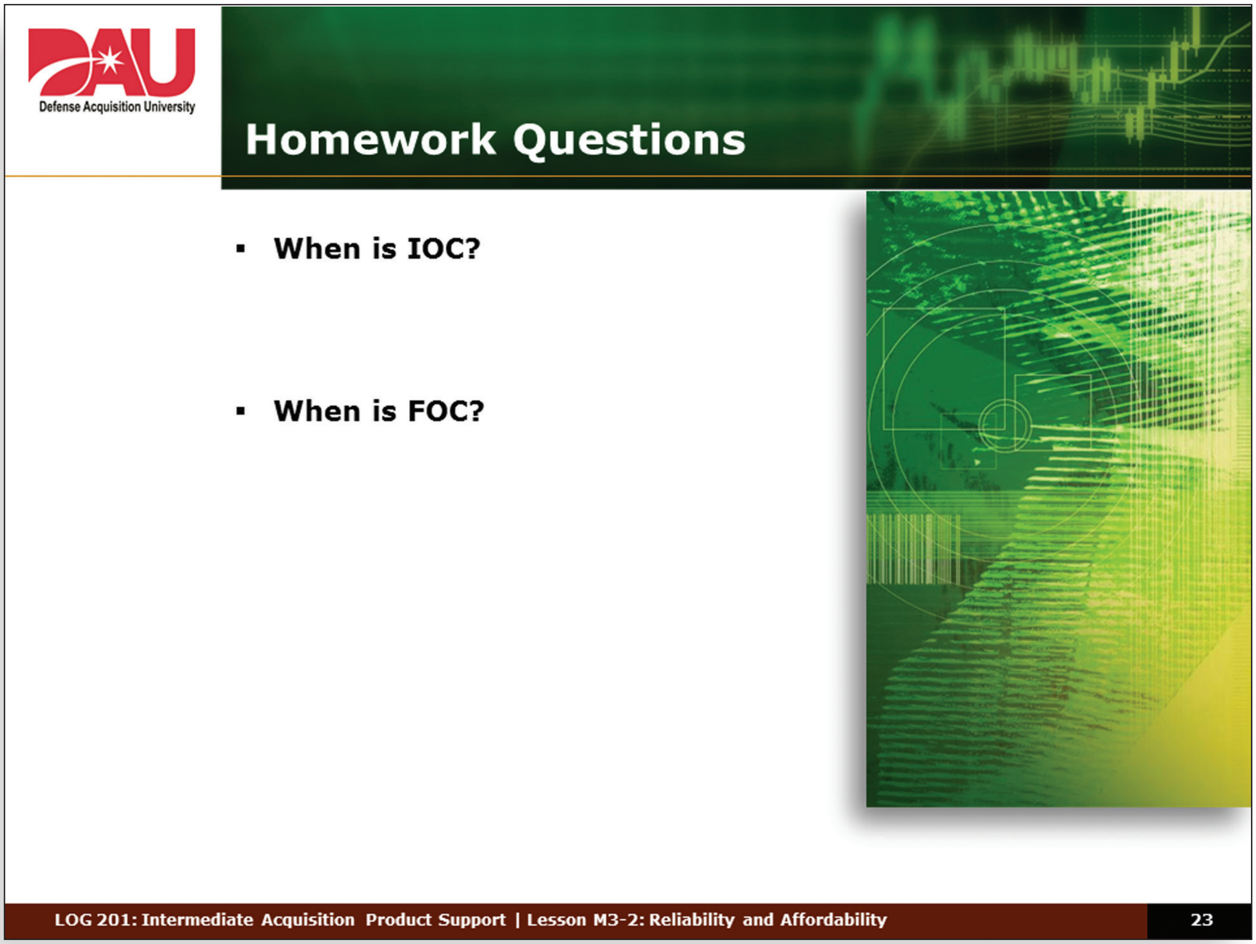
Back to our initial question: "Why should I care about O&S costs?" With the promise of budget cuts and accelerating efficiencies to defense programs, DoD will face continuous pressure to reduce development and procurement budget accounts. Additionally, modernization programs as well as sustainment budget accounts will also be impacted. This will present many problems not only for PMs responsible for new programs, but also for operational commanders responsible for sustaining our deployed forces. Numerous Service and materiel support agencies will also be responsible for reducing costs for supporting program offices and operational commanders.

But this is nothing many of us have not seen before. What is new to many of us is that expanding O&S costs garner ever more attention from senior DoD decision makers with regard to the total ownership costs of programs. If weapon systems are not sustainable within DoD budgets, the risks of major delays or cancellations will increase. It is up to the acquisition professionals who develop, procure, and field weapon systems to adopt a total life cycle approach to get the best value for our warfighters on or ahead of schedule and below costs. This urgency will be shared by the many organizations that service and support our weapon systems once they are in the hands of our warfighters. Understanding the requirements is a difficult task, but it is incumbent on all of us to understand the impacts of our decisions on O&S costs.

After all, we bought the thing; it would be nice to drive it a while.

The authors can be contacted at **michael.taylor@dau.mil** *and* **joseph.murphy@osd.mil**.

Homework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Homework Questions
When is IOC?
When is FOC?
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Lesson 4-1

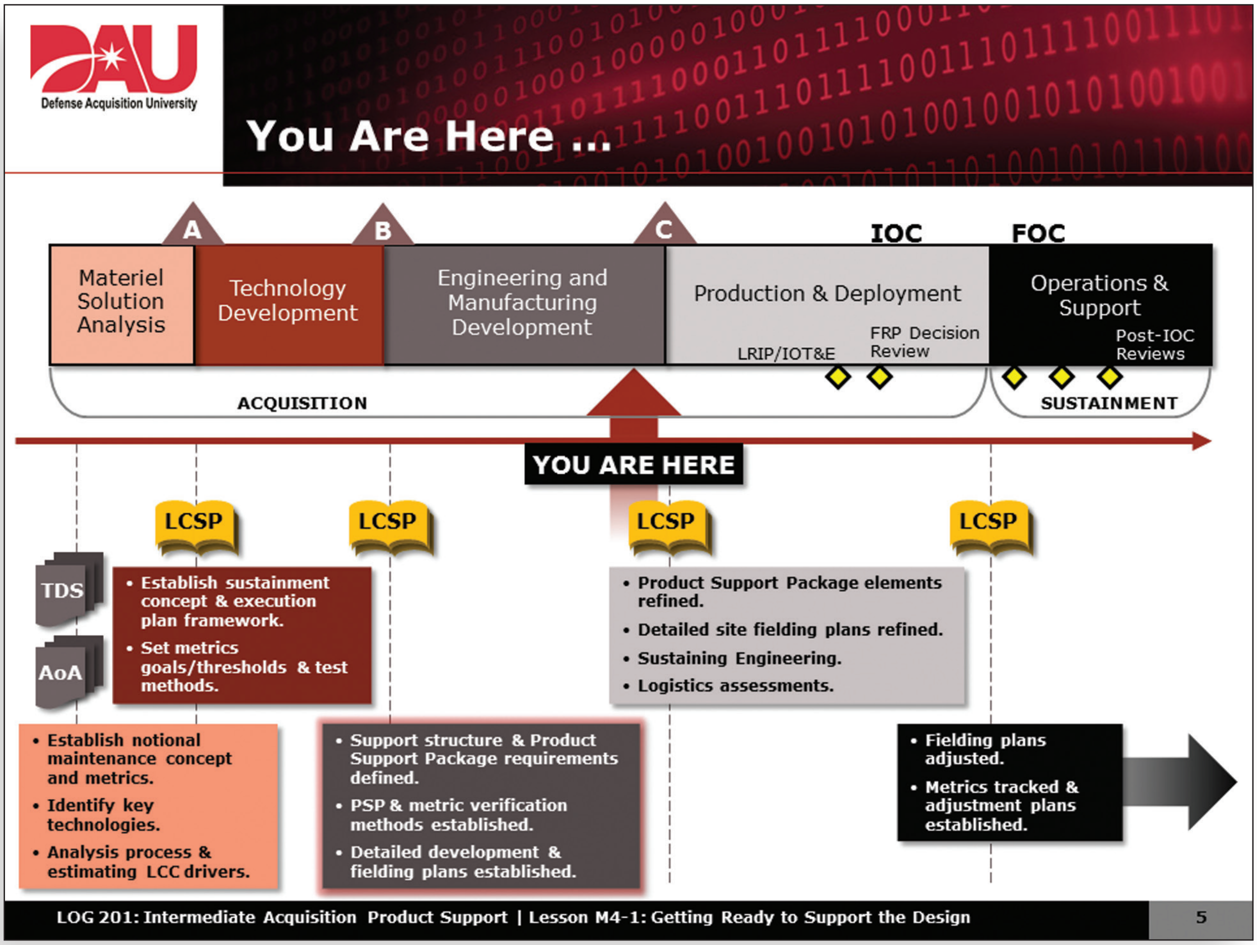
Building the Sustainment Quad Chart

Lesson Objectives:

- Given a Life Cycle Sustainment Plan (LCSP) outline, program, policy and program data, describe the information needed for building a Sustainment Quad Chart.
- Given a Life Cycle Sustainment Plan (LCSP) outline, program, policy and program data, through facilitated class discussion, build a Strike Talon Sustainment Quad Chart.

What's In It for Me?

- You will understand the four required segments for a Sustainment Quad Chart.
- You will understand the relevancy of these categories in describing a program's health.



Background for this lesson

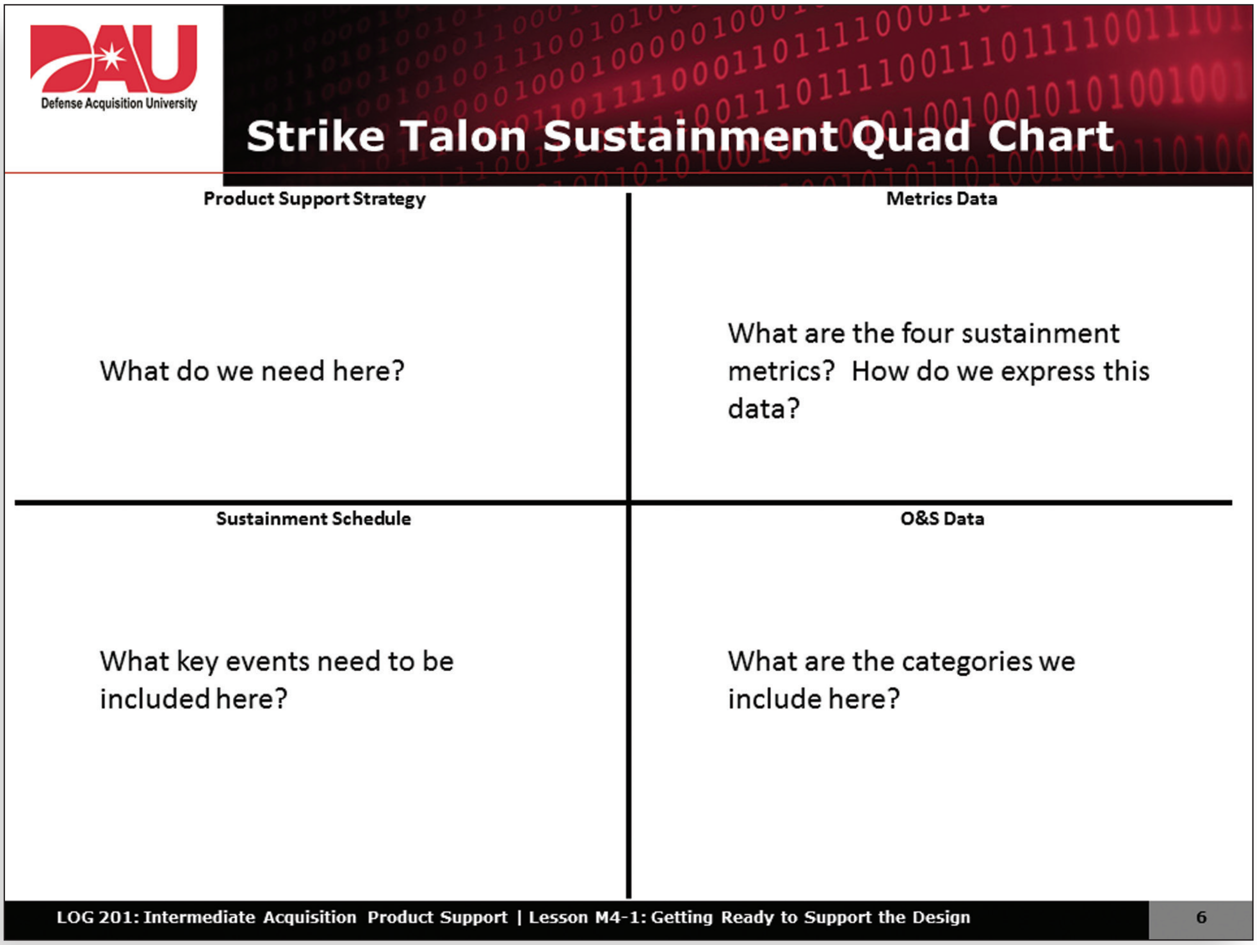
Team Strike Talon is quickly approaching Milestone C. Things have been going well which makes the Program's Product Support Manager, Hugh R. Flavonoid a little nervous. He has been the PSM for this program for five years. He has been looking forward to this day when the Strike Talon can finally make its way to production and be delivered to the Navy and Air Force.

However, he is not used to things going so well. He has worked on other acquisition programs that had support problems. He has learned from his experiences and from DAU courses. To make sure Strike Talon is supported properly, he insisted his team build and implement their Product Support Strategy using the 12 IPS elements as their framework. They carefully analyzed trades between the elements to make sure they were providing the best possible product support strategy for the system. He also stressed the team always make its case for support in the terms that hit home with the PM: cost, schedule and performance. The PM, Capt. R.K. Davidson, has been receptive to the product support team's inputs. The team has had recent success in getting needed engineering changes included in the Prognostics Health Management System.

As Milestone C approaches, it is time to update the Sustainment Quad chart. Hugh has updated information to provide to the team and must make sure the chart includes all critical information and does not report extraneous information. The table below lists the key data elements he believes belong on the quad chart.

Using the information listed below, you will walk through building the Strike Talon Sustainment Quad Chart as a class. This facilitated discussion helps with understanding the approach, process, and key points we want to present at our Milestone C decision brief.

- Current Status of Strike Talon—Product Support Strategy
- Sustainment Schedule
- Metrics Data
- O&S Cost Data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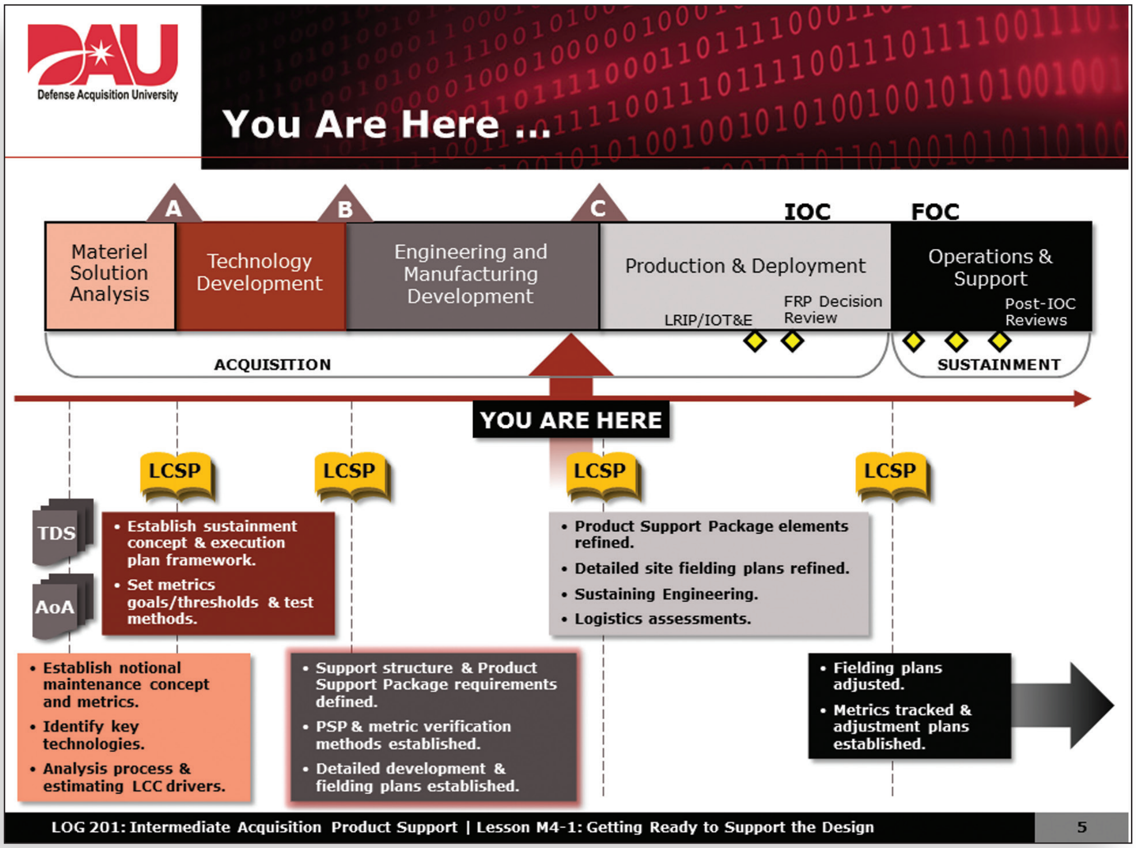
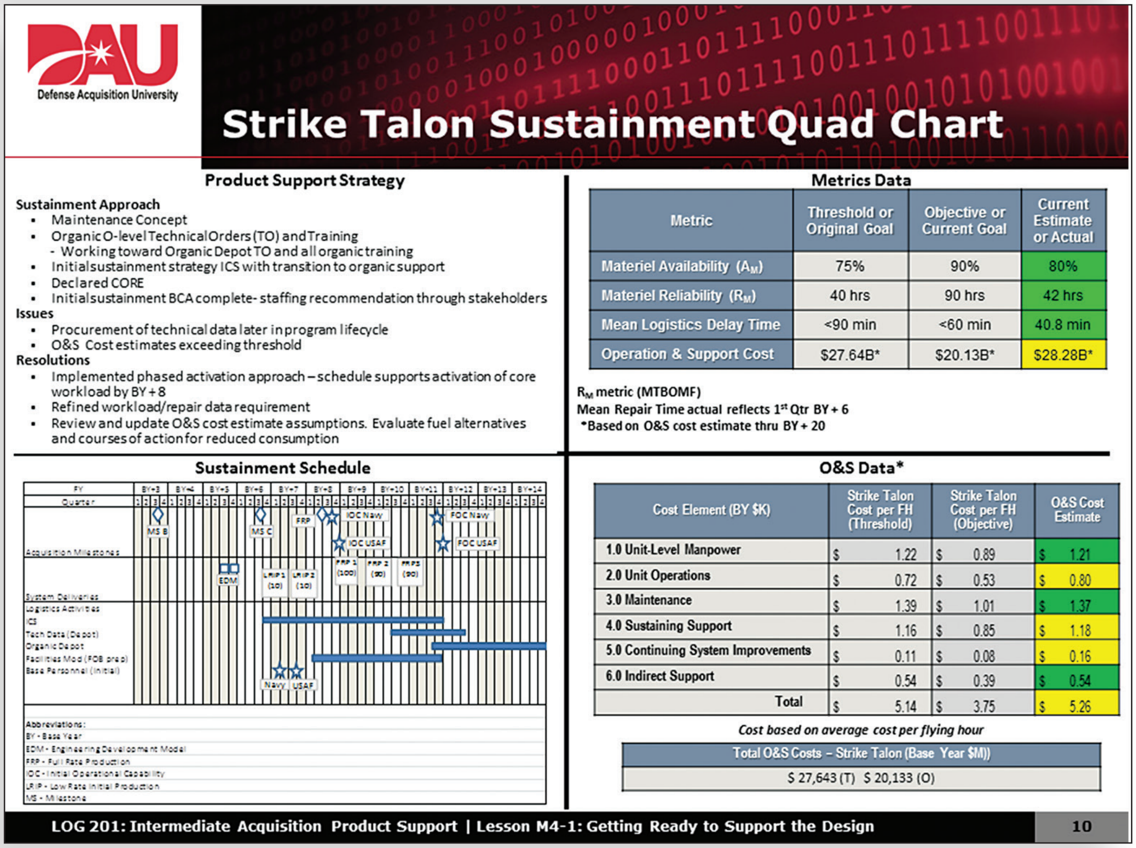
Strike Talon Sustainment Quad Chart
Product Support Strategy
What do we need here?
Metrics Data
What are the four sustainment metrics? How do we express this data?
Sustainment Schedule
What key events need to be included here?
O&S Data
What are the categories we include here?
LOG 201: Intermediate Acquisition Product Support | Lesson M4-1: Getting Ready to Support the Design
6

Notes:

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Strike Talon Sustainment Quad Chart

Product Support Strategy

Sustainment Approach
- Maintenance Concept
- Organic O-level Technical Orders (TO) and Training
  - Working toward Organic Depot TO and all organic training
- Initial sustainment strategy ICS with transition to organic support
- Declared CORE
- Initial sustainment BCA complete- staffing recommendation through stakeholders

Issues
- Procurement of technical data later in program lifecycle
- O&S Cost estimates exceeding threshold

Resolutions
- Implemented phased activation approach – schedule supports activation of core workload by BY + 8
- Refined workload/repair data requirement
- Review and update O&S cost estimate assumptions. Evaluate fuel alternatives and courses of action for reduced consumption

Metrics Data

Metric	Threshold or Original Goal	Objective or Current Goal	Current Estimate or Actual
Materiel Availability (A_M)	75%	90%	80%
Materiel Reliability (R_M)	40 hrs	90 hrs	42 hrs
Mean Logistics Delay Time	<90 min	<60 min	40.8 min
Operation & Support Cost	$27.64B*	$20.13B*	$28.28B*

R_M metric (MTBOMF)
Mean Repair Time actual reflects 1st Qtr BY + 6
*Based on O&S cost estimate thru BY + 20

Sustainment Schedule

O&S Data*

Cost Element (BY $K)	Strike Talon Cost per FH (Threshold)	Strike Talon Cost per FH (Objective)	O&S Cost Estimate
1.0 Unit-Level Manpower	$ 1.22	$ 0.89	$ 1.21
2.0 Unit Operations	$ 0.72	$ 0.53	$ 0.80
3.0 Maintenance	$ 1.39	$ 1.01	$ 1.37
4.0 Sustaining Support	$ 1.16	$ 0.85	$ 1.18
5.0 Continuing System Improvements	$ 0.11	$ 0.08	$ 0.16
6.0 Indirect Support	$ 0.54	$ 0.39	$ 0.54
Total	$ 5.14	$ 3.75	$ 5.26

Cost based on average cost per flying hour

Total O&S Costs – Strike Talon (Base Year $M))
$ 27,643 (T) $ 20,133 (O)

LOG 201: Intermediate Acquisition Product Support | Lesson M4-1: Getting Ready to Support the Design
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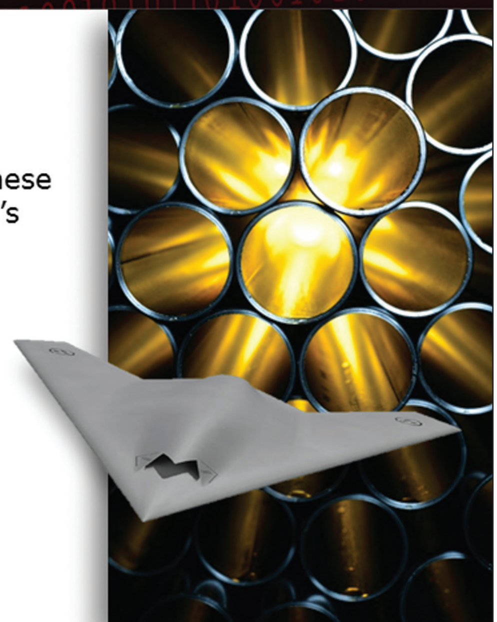
Summary

- You understand the four required segments for a Sustainment Quad Chart.
- You understand the relevancy of these categories in describing a program's health.



LOG 201: Intermediate Acquisition Product Support | Lesson M4-1: Getting Ready to Support the Design 12

Notes:

Lesson 4-2

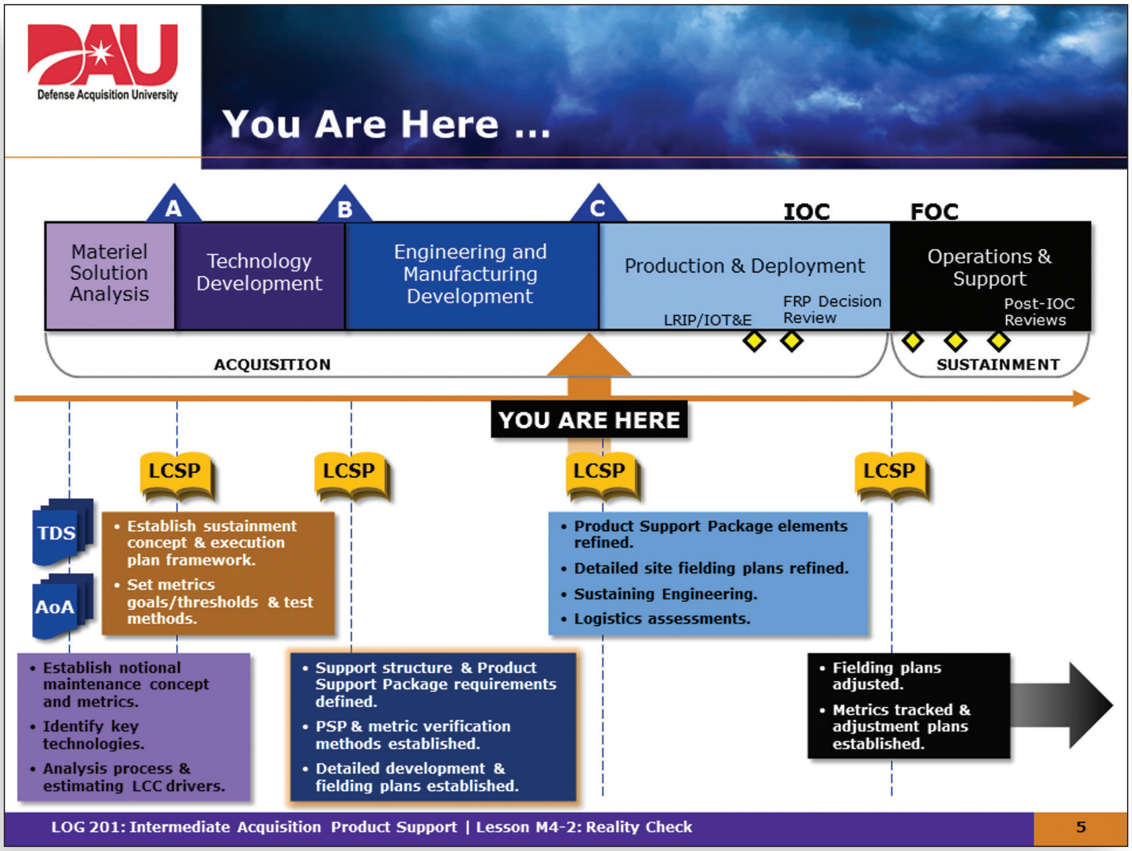
Reality Check

Lesson Objectives:

- Given a Product Support Strategy, Life Cycle Sustainment Plan (LCSP), policy, framework documents, and a case scenario, evaluate the effect of program changes to the Product Support Strategy.
- Given a Product Support Strategy, Life Cycle Sustainment Plan (LCSP), policy, framework documents, and a case scenario, brief the effect of program changes to the Product Support Strategy and the recommended actions.

What's In It for Me?

- You will understand that change is the only certainty.
- You will understand how different events affect the Product Support Strategy.
- You will understand how to review the LCSP and update based on program changes.



Defense Acquisition University

Program Changes

- **We have a working LCSP.**
- **We've updated it throughout the Life Cycle.**
- **Now we're approaching Milestone C … .**
- **What happens when there are changes to the Program?**
  - How do we adjust our Product Support Strategy and how do we reflect in our LCSP?
  - What IPS elements does the change affect?
  - What is the decision-making process, and how are the decisions made?

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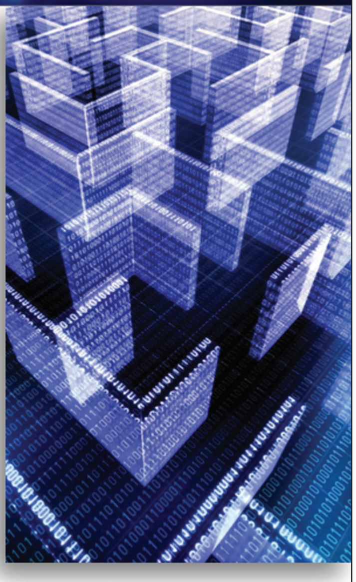
Your Task ...



- Each team will select a different Program change.
- Read case and, using the case information, evaluate the Product Support Strategy and LCSP within the context of the change you select.
- Prepare a 15-minute update brief (using template provided) to include:
  - How does the Program change affect our Product Support Strategy?
  - How does the Program change affect the LCSP?
  - What IPS element(s) are affected most/least? How and why?
  - What key risk(s) arise, and how do we manage?
- Add any other material you deem supports your position.

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Planning Timeline

- Thursday morning
  - Analyze change.
  - Assess potential impacts.
- Thursday afternoon
  - Document potential impacts.
  - Include the how and whys.
  - Develop risk assessment and identify strategy/plan revisions.
  - Deliver hard copy of brief to instructor at end of day.
- Friday morning—deliver briefing.

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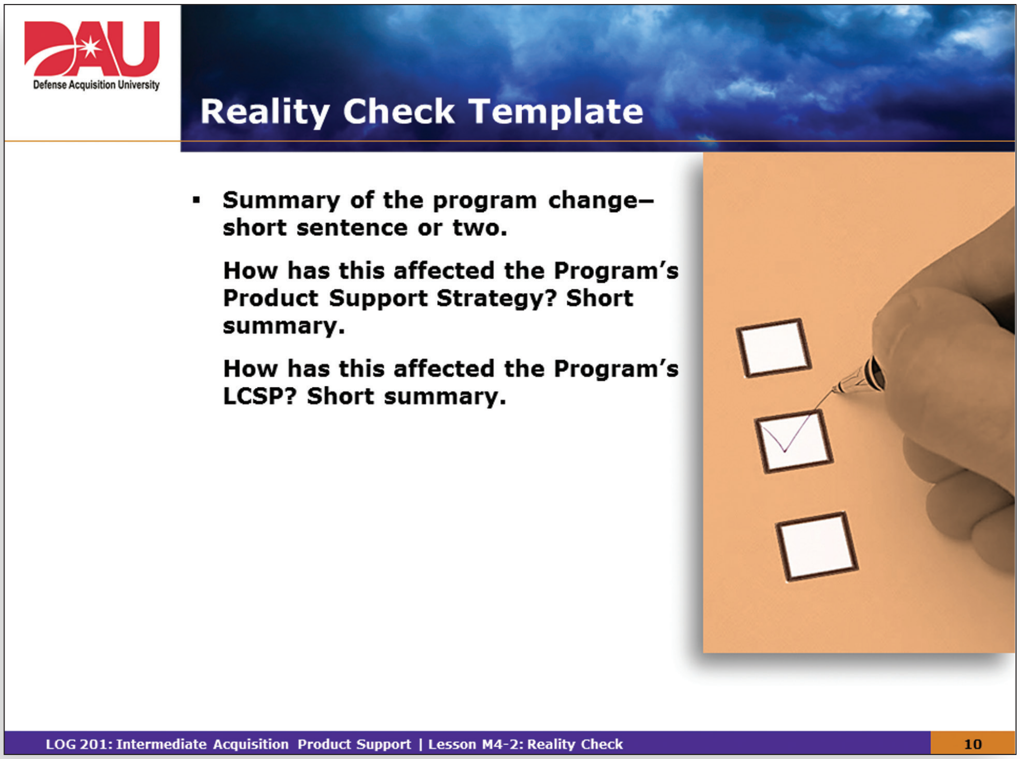
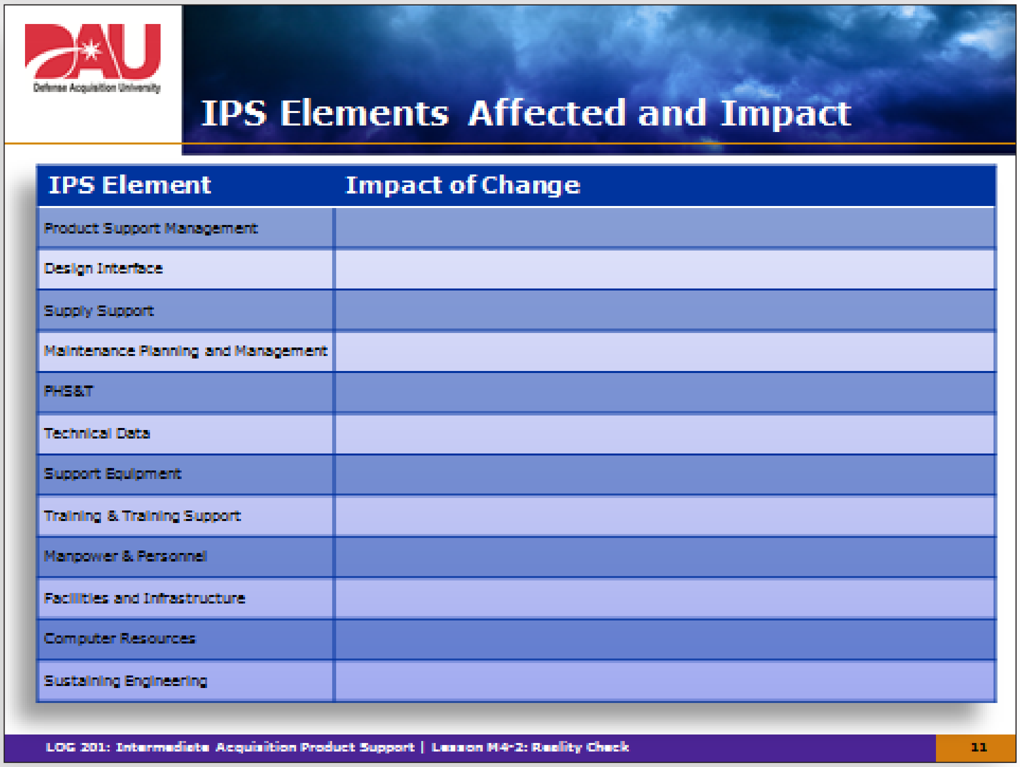
The following template slides are available in your Team's class shared folder





IPS Element	Impact of Change
Product Support Management	
Design Interface	
Supply Support	
Maintenance Planning and Management	
PHS&T	
Technical Data	
Support Equipment	
Training & Training Support	
Manpower & Personnel	
Facilities and Infrastructure	
Computer Resources	
Sustaining Engineering	

Capstone
Assessing Logistics Risk

IPS Element(s):

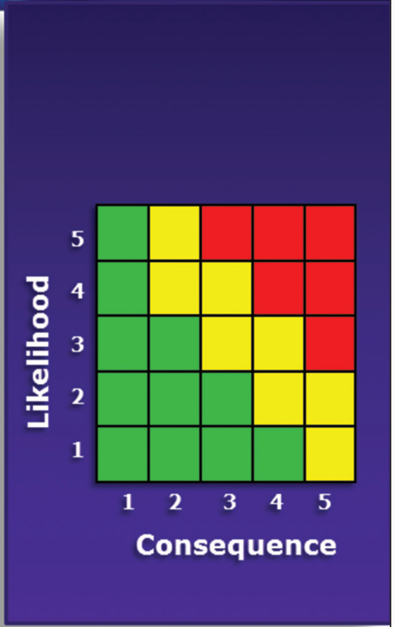
Risk Title:

Risk Category: Schedule/Cost/ Performance *(Select one or several)*

Risk Description:

Root Cause:

Management Plan:



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12

Case Scenarios for Capstone Exercise

Scenario Number 1:

Addition to UCAS Production Quantity

Combat Commanders (COCOMs) are excited about the introduction of the new UCAS, Strike Talon. Having that level of endurance and the ability to stealthily observe from high altitudes will fill a very large hole in the United States' combat capability. Most important to them is the ability of Strike Talon to work with existing manned systems and long-range precision strike weapons to remotely target high-interest assets with very low risk to U.S. Forces and noncombatants. In fact, the COCOMs might be a little too enthused over the Strike Talon's procurement.

To the COCOMs, the Strike Talon UCAS represents the next generation in unmanned combat. Previous versions of UAVs have been judged primitive by comparison. To that end, they have recommended retiring many of the UAV versions used in the Middle East War and replacing them with Strike Talon UCAS. They cite a significant reduction in operating costs and manpower as justification and have published a white paper citing a return on investment (ROI) projection of 1.5 to 2.0.

None of this would have been taken too seriously except that the white paper found itself in the hands of the Office of Management and Budget (OMB) and key congressional staffers. One key clause that caught their attention was that, in exchange for procuring 20 more Strike Talon UCASes, the COCOMs would accept an immediate 10 percent cut in their combined operating budgets. That got OMB's attention, and the COCOM's request was immediately granted.

You find out Monday morning that 50 additional UCASes have been added to the production contract as your program is approaching a Milestone C decision review. Your program's support strategy has been carefully crafted to accommodate 300 UCASes, and now you have 350.

- How will you adjust your product support strategy, and how do you reflect the change in the LCSP?

- What IPS Elements does the change affect?
- What is the decision-making process, and how are the decisions made?

In short, what are you going to do?

Scenario Number 2

Endangered Species Conundrum

The Good News: After years of thought, deliberation and negotiation, facilities for the 300 UCASes (170 Navy, 130 Air Force) have been identified acquired. Overseas base commanders are excited to have the influx of people and occupation of hangar spaces that have been vacant since shortly after the Bosnia conflict.

The Bad News: Given that the facilities have not been occupied for several years, they will require extensive renovation.

The Good News: Funds have been set aside to accomplish the facility renovations to accommodate Strike Talon.

The Bad News: Site surveys were completed over 2 years ago. Since that time, at one proposed basing location, an endangered species, (as identified by the World Wildlife Federation), Tomicus simsicus horribilis, (a small terrapin) has taken up residence in earthen areas adjacent to the facilities. The World Wildlife Federation has successfully submitted an injunction prohibiting

Strike Talon's deployment there until an environmental study and mitigation steps taken. This is expected to take 5 to 7 years.

- How will you adjust your product support strategy and how do you reflect the change in the LCSP?
- What IPS Elements does the change affect?
- What is the decision-making process and how are the decisions made?

In short, what are you going to do?

Scenario Number 3

BRAC Happens

As part of building your LCSP you performed a Depot Source of Repair (DSOR) study and determined Fleet Readiness Center (FRC) Bonifay, Fla., was to be Strike Talon's primary depot. Your program has spent the last 2 years renovating facilities, installing test equipment, and training artisans there.

Everyone is excited to have the influx of work and people to depot that, frankly, has not been that competitive lately. As a result, much of the work previously performed there has been relocated to other depots and, in a surprise move, the workload for one helicopter program Bonifay was competing for was moved overseas. This negatively impacted the small community both economically and motivationally, so announcing Strike Talon's eventual workload gave them a promising future.

Unfortunately, the DSOR, depot determination, and announcement of Strike Talon's arrival at FRC Bonifay all were performed ahead of the latest congressional Base Re-Alignment and Closure (BRAC) mandate. Bonifay was on the list and slated for closure prior to the start of the next fiscal year.

You find out Monday morning that the primary depot you selected for Strike Talon is closing within the next year just as your program is approaching a Milestone C decision review. You have invested heavily in tooling, test equipment, and training there.

- How will you adjust your product support strategy, and how do you reflect the change in the LCSP?
- What IPS Elements does the change affect?
- What is the decision-making process, and how are the decisions made?

In short, what are you going to do?

Scenario Number 4

Contractor Bankrupt

The business case analysis (BCA) you performed recommended performance-based logistics as the best-value support strategy for Strike Talon.

In line with that, your program office released a request for proposal

(RFP) and subsequently awarded the original equipment manufacturer

(OEM), Acme Aircraft Corp., oversight for the contract as the product support integrator (PSI). The contract was a 5-year fixed-price with five 1-year options.

Everyone agreed this was the perfect scenario as Acme came on board early, a full year prior to fielding, in order to help implement Strike Talon's fielding and support.

Last week, very unexpectedly, the subcontractor Acme hired to provide PSI services announced financial insolvency and was bankrupt. All employees and support contracts immediately were terminated, leaving Strike Talon with no viable support strategy. Your office has no choice but begin the PSI contract process over from scratch at this late date.

- What will you do in the interim?
- How will you adjust your product support strategy, and how do you reflect the change in the LCSP?
- What IPS Elements does the change affect?
- What is the decision-making process and how are the decisions made?

In short, what are you going to do?

Scenario Number 5

Program Office Can't Afford PBL

Early in the Engineering and Manufacturing Development (EMD) Phase, your office performed the product support strategy BCA, which indicated a performance-based logistics (PBL) support strategy was the best value to the government. You briefed this to the program manager and milestone decision authority (MDA) at the Post-CDR Assessment programmatic review and, receiving permission to proceed, have built all Strike Talon support plans around a PBL strategy.

Typical PBL contracts are for long periods (up to 5 years with five 1-year options) so industry is able to spread out or amortize its set-up costs over a long period and multiple assets. If not, all industry costs for Lean Six Sigma Processes, production line set-ups, updating technology in the equipment, etc., would be concentrated on a smaller base and be unaffordable. PBL contracts bring large expenditures to the government which, while cheaper in the long-run, must be paid upfront as opposed to the incremental payments over extended periods for transactional strategies. In short, PBL contracts present cash-flow problems for the government and must be planned well in advance to be implemented properly.

Last week, the program manager called you in for some bad news. With serious intent on getting governmental spending under control, the OMB slashed defense spending 10 percent across the board. After much deliberation with the MDA, they have decided your program will not be able to afford the PBL strategy and you now must go with the traditional, three-level transactional maintenance concept.

Think of the elements in your support strategy you have not accomplished since you were planning on PBL. While you may have an exit strategy where tech data, special tooling, etc., can be purchased, all that requires lead time.

- What will you do in the interim?

- What will you do for the long term?
- How will you adjust your product support strategy, and how do you reflect the change in the LCSP?
- What IPS Elements does the change affect?
- What is the decision-making process, and how are the decisions made?

In short, what are you going to do?

Scenario Number 6

Dilithium is a Carcinogen

To make the aircraft as light as possible, Strike Talon engineers made the landing gear struts out of a lightweight, strong, corrosion-resistant material called dilithium. Showing great promise for the marine industry as well as aviation, dilithium has the added benefit of large ore deposits in Utah and Wyoming, thereby guaranteeing the U.S. Government an uninterrupted supply. Unlike many other exotic metals, no foreign governments are involved in dilithium production.

It sounds like the perfect solution. However, there's a problem. Last week the American Medical Association identified dilithium as a major carcinogen and, as a result, all production processes involving dilithium have been banned. Strike Talon must now go back for reengineering for the landing gear redesign. Engineers estimate there will be a 2-year delay in delivery schedules.

- How does a 2-year delay impact your support strategy plans?
- Are there any negative aspects of this delay from a logistics perspective?
- What will you do in the interim?
- What will you do for the long term?

- How will you adjust your product support strategy and how do you reflect the change in the LCSP?
- What IPS Elements does the change affect?
- What is the decision-making process, and how are the decisions made?

In short, what are you going to do?

A

ACAP	Automated Curriculum Authoring Program
ACAT	Acquisition Category
ACETEF	Air Combat Environmental Test and Evaluation Facility
ACOE	Aircraft Common Operating Equipment
ACR	Airborne Communication Relay
ADL	Advanced Distributive Learning
ADM	Acquisition Decision Memorandum
ADP	Automatic Data Processing
AIS	Automatic Identification System
AIT	Automated Information Technology
AL	Acquisition Logistics
ALS	Acquisition Logistics Support
ALSP	Acquisition Logistics Support Plan
AMD	Activity Manning Document
A_o	Operational Availability
AoA	Analysis of Alternatives
APB	Acquisition Program Baseline
APEO	Assistant Program Executive Officer
API	Application Program Interfaces
APML	Assistant Program Manager for Logistics
APMSE	Assistant Program Manager for Systems and Engineering
APN	Aircraft Procurement (Navy)
AS	Acquisition Strategy
ASN(RDA)	Assistant Secretary of the Navy for Research, Development and Acquisition
ASPO	Avionics Systems Project Officer
ASR	Acquisition Strategy Report
AT	Anti-Tamper
AT&L	Acquisition, Technology and Logistics
ATC	Air Traffic Control
ATE	Automated Test Equipment
ATL	Acquisition Technology and Logistics
ATM	Air Traffic Management
ATO	Approval to Operate
ATS	Automated Test Sets
AVCAL	Aviation Consolidated Allowance

B

BCA	Business Case Analysis
BDA	Battle Damage Assessment
BI	Battlespace Interoperability Team
BIT	Built-In Test
BLOS	Beyond Line-of-Sight
BOM	Bill of Material

C

C^2	Command and Control
C4I	Command, Control, Communications, Computers, and Intelligence
C4ISR	Command, Control, Communications, Computers, Intelligence, Surveillance, and Reconnaissance
CA	Contract Award
CAE	Component Acquisition Executive
CAI	Computer-Aided Instruction
CAIV	Cost as an Independent Variable
CaNDI	Commercial and Nondevelopmental Items

CAO	Competency Aligned Organization
CAPE	Cost Analysis and Program Evaluation
CARD	Cost Analysis Requirements Description
CASS	Consolidated Automated Support System
CAVTS	Cost Adjustment and Visibility Tracking System
CBA	Capabilities-Based Assessment
CBM	Condition-Based Maintenance
CBM+	Condition-Based Maintenance Plus
CBT	Computer-Based Training
CCA	Clinger-Cohen Act
CCB	Configuration Change Board
CCDR	Contractor Cost Data Report
CCJO	Capstone Concept for Joint Operations
CD	Counter Drug
CDD	Capability Development Document
CDL	Common Data Link
CDR	Critical Design Review
CDRL	Contract Data Requirements List
CD-ROM	Compact Disc-Read Only Memory
CE/A	Cost Estimating/Analysis
CETS	Contractor Engineering and Technical Services
CFE	Contractor Furnished Equipment
CFTD	Contractor Flight Test Director
CHBDL	Common High-Bandwidth Data Link
CI	Configurations Items
CID	Commercial Item Description
CIO	DoD Chief Information Officer
CITE	Centers of Industrial and Technical Excellence
CJCS	Chairman of the Joint Chiefs of Staff
CJCSI	Chairman of the Joint Chiefs of Staff Instruction
CJCSM	Chairman of the Joint Chiefs of Staff Manual
CL	China Lake
CLIN	Contract Line Item Number
CLS	Contractor Logistics Support
CM	Configuration Management
CMMI	Capability Maturity Model Integration
CMP	Configuration Management Plan
CNA	Computer Network Attack
CNA	Center for Naval Analysis
CNATTU	Center for Naval Aviation Technical Training Unit
CNE	Computer Network Exploitation
CNO	Chief of Naval Operations
CNS	Communication, Navigation, Surveillance
CNS/ATM	Communication, Navigation, Surveillance/Air Traffic Management
COE	Common Operating Environment
COI	Communities of Interest
COI	Critical Operational Issues
COI	Course of Instruction
COMOPTEVFOR	Commander, Operational Test & Evaluation Force
COMPUSEC	Computer Security
COMSEC	Communications Security
CONOPS	Concept of Operations
CONUS	Continental United States
COS	Contractor Operational Support
COSAL	Coordinated Shipboard Allowance List
COTP	Common Operational and Tactical Picture
COTS	Commercial-Off-The-Shelf
CPAF	Cost Plus Award Fee
CPAF/IF	Cost Plus Award Fee/Incentive Fee
CPD	Capabilities Production Document
CPFF	Cost-Plus Fixed Fee
CPI	Continuous Process Improvement
CPI	Critical Program Information
CPIF	Cost-Plus Incentive Fee
CPR	(See IPMR)
CPRG	Commander, Patrol and Reconnaissance Group
CPU	Computer Processing Unit

CRD	Capstone Requirements Document
CRI	Cost Reduction Initiatives
CRLCMP	Computer Resources Life-Cycle Management Plan
CRSMP	Computer Resource Support Management Plan
CS	Communication Suite
CSDB	Common Source Data Base
CSCI	Computer Software Configuration Item
CSE	Common Support Equipment
CSG	Carrier Strike Group
CSI	Critical Safety Items
CSIL	Contractor SIL
CT	Certification Testing
CT	Contractor Testing
CT&E	Contractor Test and Evaluation
CTE	Critical Technology Elements
CTP	Critical Technical Parameters
CVN	Carrier Nuclear
CWBS	Contract Work Breakdown Structure

D

D,PA&E	Director, Program Analysis and Evaluation
DAA	Designated Approval Authority
DAB	Defense Acquisition Board
DADMS	Depasrtment of the Navy Applications and Database Management System
DAE	Defense Acquisition Executive
DAES	Defense Acquisition Executive Summary
DAG	Defense Acquisition Guidebook
DAL	Data Accession List
DASC (DAWG)	Department of the Army System Coordinator
DCGS-N	Distributed Common Ground System-Navy
DCMA	Defense Contract Management Agency
DCN	Design Change Notice
DCRC	Defense Cost and Resource Center
DDAA	Developmental Designated Approving Authority
DDS	Data Download System
Demil	Demilitarization
DES	Deployment, Employment, and Sustainment
DFAR	Defense Federal Acquisition Regulation
DFARS	Defense Federal Acquisition Regulation Supplement
DI	Design Interface
DIA	Defense Intelligence Agency
DIACAP	Department of Defense Information Assurance Certification and Accreditation Processes
DII-COE/ NCES	Defense Information Infrastructure Common Operating Environment/Net Centric Enterprise Services
DISN	Defense Information Systems Network
DISR	Department of Defense Information Technology Standards Registry
DISR	Director of Intelligence, Surveillance, and Reconnaissance
DISR	DoD Information Technology Standards Registry
DITR	DoD Information Technology Repository
DITSCAP	DoD Information Technology Security Certification and Accreditation Process
DLA	Defense Logistics Agency
DLR	Depot Level Repairable
DM	Data Management
DMMH/FH	Direct Maintenance Man Hour per Flight Hour
DMS/MS	Diminishing Manufacturing Sources and Material Shortages
DMSMSP	Diminishing Manufacturing Sources and Material Shortages Plan

DMT	DMSMS Management Team
DoD	Department of Defense
DoDAF	Department of Defense Architecture Framework
DoDD	Department of Defense Directive
DoDI	Department of Defense Instruction
DoN	Department of the Navy
DOORS	Dynamic Object-Oriented Requirements System
DOT&E	Director, Operational Test and Evaluation
DOTmLPF-P	Doctrine, Organization, Training, Material, Leadership and Education, Personnel, and Facilities
DPPG	Defense Planning and Programming Guidance
DREN	Defense Research and Engineering Network
DRMT	Design Reference Mission Profile
DSOR	Depot Source of Repair
DT	Developmental Test
DT&E	Developmental Test and Evaluation
DUSD (L&MR)	Deputy Under Secretary for Defense for Logistics and Materiel Readiness
DVD	Direct Vendor Delivery

E

E3	Electromagnetic, Environmental Effects
ECM	Electromagnetic Compatibility
ECP	Engineering Change Proposal
EDM	Engineering Development Model
EDRAP	Engineering/Data Requirements Agreement Plan
EEE	Electrical, Electronic and Electromechanical
EI	Engineering Investigations
EIS	Environmental Impact Statement
ELC	Electronic Learning Centers
ELINT	Electronic Intelligence
E-LORA	Economic Level of Repair Analysis
ELUP	Engine Life Usage Processor
EMC	Electromagnetic Compatibility
EMCON	Emission Control
EMD	Engineering and Manufacturing Development
EME	Electromagnetic Environment
EMI	Electromagnetic Interference
EO	Electro-optical
EO	Executive Orders
EOB	Enemy of Battle
EPA	Environmental Protection Agency
EPAT	Environmental Process Action Team
ERB	Executive Review Board
ESG	Expeditionary Strike Group
ESM	Electronic Surveillance Measures
ESOH	Environmental, Safety, and Occupational Health
ETOS	Effective Time On Station
EUCOM	European Command
EVM	Earned Value Management
EVMS	Earned Value Management System

F

FAA	Federal Aviation Administration
FAA	Functional Area Analysis
FAC	Facilities
FAM	Functional Area Manager
FAR	Federal Acquisition Regulation
FCA	Functional Configuration Audit
FCB	Functional Capabilities Board
FD	Fault Detection
FEA	Front End Analysis
FFP	Firm Fixed Price
FI	Fault Isolation
FIT	Fleet Introduction Team
FMC	Full Mission Capable
FMECA	Failure Mode, Effects, and Criticality Analysis
FMR	Financial Management Regulation
FMS	Foreign Military Sales
FNA	Functional Needs Analysis
FOB	Forward Operating Base
FOC	Full Operation Capable
FoS	Family of Systems
FOT&E	Follow on Operational Test and Evaluation
FPAF	Fixed-Price Award Fee
FPIF	Fixed-Price Incentive Fee
FQ&P	Flying Qualities and Performance
FQT	Flight Qualification Test
FRACAS	Failure Reporting Analysis and Corrective Action System
FRC	Fleet Readiness Center
FRD	Facility Requirements Data
FRP	Full Rate Production
FRP	Fleet Response Plan
FRR	Flight Readiness Review
FRS	Fleet Replacement Squadron
FSA	Functional Solutions Analysis
FSC	Flight Stress Computer
FSO	Flight Systems Operator
FST	Fleet Support Team
FTA	Fault Tree Analysis
FTE	Full-Time Equivalents
FTS	Flight Termination System
FY	Fiscal Year
FYDP	Future Years Defense Program

G

GATM	Global Aviation Traffic Management
GCCS	Global Command and Control System
GES	Global Information Grid Enterprise Services
GFE	Government-Furnished Equipment
GFF	Government-Furnished Facilities
GFI	Government-Furnished Information
GFP	Government-Furnished Property
GFTD	Government Flight Test Director
GH	Global Hawk
GHMD	Global Hawk Maritime Demonstrator
GIG	Global Information Grid
GIG MA ICD	Global Information Grid Mission Area Initial Capabilities Document
GOGO	Government-Owned, Government-Operated

GOTS	Government Off-the-Shelf
GPS	Global Positioning System
GS	Global Strike
GSE	Ground Support Equipment
GSIL	Government Systems Integration Lab
GTS	Ground Target Set

H

HALE	High-Altitude Long Endurance
HERF	Hazards of Electromagnetic Radiation to Fuels
HERO	Hazards of Electromagnetic Radiation to Ordinance
HERP	Hazards of Electromagnetic Radiation to Personnel
HFE	Human Factor Engineering
HHS	Hydraulic Health Subsystem
HIS	Human System Integration
HITL	Hardware In the Loop
HLA	High-Level Architecture
HLS/HLD	Homeland Security/Homeland Defense Operations
HM	Hazardous Material
HMMP	Hazardous Material Management Program
HRI	Hazard Risk Index
HS	Homeland Security
HSI	Human Systems Integration
HSIP	Human System Integration Plan

I

IA	Information Assurance
IADS	Integrated Air Defense System
IAT	Integrated Avionics Trainer
IATO	Interim Approval to Operate
IAW	In Accordance With
IBIT	Initiated Built-in Test
IBR	Integrated Baseline Review
ICD	Initial Capabilities Document
ICEP	Interoperability Certification and Evaluation Plan
ICS	Interim Contractor Support
ID	Identification
IDDE	Integrated Digital Data Environment
IDE	Integrated Digital Environment
IDE	Integrated Data Exchange
IDM	Information Dissemination Management
IEPR	Independent Expert Program Review
IER	Information Exchange Requirements
IETM	Interactive Electronic Technical Manual
IFF	Identification Friend or Foe
ILA	Independent Logistics Assessment
ILE	Integrated Learning Environment
ILS	Integrated Logistics Support
IMC	Integrated Maintenance Concept
IMP	Integrated Master Plan
IMS	Integrated Master Schedule
IO	Information Operations
IOC	Initial Operational Capability
IOCSR	Initial Operational Capability Supportability Review
IOT&E	Initial Operational Test and Evaluation
IP	Internet Protocol
IPB	Illustrated Parts Breakdown

IPL	Integrated Priority List
IPMR	Integrated Program Assessment Report
IPR	In-Process Review
IPS	Integrated Program Schedule
IPSE	Integrated Product-Support Element
IPT	Integrated Product Team
IR	Infrared Radar
IRS	Interface Requirements Specification
ISD	Instructional Systems Development
ISD	Instructional Systems Design
ISEET	Integrated Systems Evaluation, Experimentation and Test Department
ISF	Integration Support Facility
ISF	Information Strike Force
ISIL	Interim Support Items List
ISP	Information Support Plan
ISR	In-Service Review or Intelligence, Surveillance and Reconnaissance
IT	Information Technology
IT	Integrated Test
ITAB	Information Technology Acquisition Board
ITP	Integrated Test Plan
ITT	Integrated Test Team
IUID	Item Unique Identification

J

JC2	Joint Command and Control System
JC2/MA	Joint Command and Control/Maritime Applications
JCB	Joint Capabilities Board
JCD	Joint Capabilities Document
JCIDS	Joint Capabilities Integration and Development System
JCPAT-E	Joint C4I Program Assessment Tool - Empowered
JCS	Joint Chiefs of Staff
JDAM	Joint Direct Attack Munitions
JFC	Joint Functional Concept
JFEO	Joint Forcible Entry Operations
JFMCC	Joint Forces Maritime Component Commander
JICs	Joint Integrating Concepts
JITC	Joint Interoperability Test Command
JMETL	Joint Mission Essential Tasks List
JMPS	Joint Mission Planning System
JOC's	Joint Operation Concepts
JPD	Joint Planning Document
JPO	Joint Program Office
JROC	Joint Requirements Oversight Council
JSC	Joint Spectrum Center
JSF	Joint Strike Fighter
JSPS	Joint Strategic Planning System
JSSG	Joint Services Specifications Guide
JTRS	Joint Tactical Radio System

K

KIP	Key Interface Profile
KPP	Key Performance Parameter
KSA	Key System Attributes

L

LCC	Life Cycle Cost
LCCE	Life-Cycle Cost Estimate
LCL	Life Cycle Logistician
LCS	Life-Cycle Sustainment
LCSP	Life Cycle Sustainment Plan
LEM	Logistics Element Manager
LFp	Logistics Footprint
LFT&E	Live-Fire Test and Evaluation
LHA	Landing Helicopter Assault
L-IPT	Logistics Integrated Product Team
LMDSS	Logistics Management Decision Support System
LMI	Logistics Management Information
LMIS	Learning Management Information System
LMS	Logistics Management System
LOI	Level of Interoperability
LOO	Letters of Observation
LORA	Level of Repair Analysis
LOS	Line-of-Sight
LRFS	Logistics Requirements and Funding Summaries
LRIP	Low-Rate Initial Production
LRM	Line Replaceable Module
LRT	Logistics Response Time
LRU	Line Replaceable Unit
LSA	Logistics Supportability Analysis
LTO	Landing-Takeoff

M

M&S	Modeling & Simulation
MA	Materiel Availability
MAC	Mission Assurance Category
MALE	Medium Altitude Long Endurance
MARSA	Military Accepts Responsibility for Separation of Aircraft
MATS	Mid-Atlantic Tracking System
MBI	Major Budget Issue
MC	Mission Capable
MC	Mission Commander
MCMTABORT	Mean Corrective Maintenance Time Abort
MCMTOMF	Mean Corrective Maintenance Time For Operational Mission Failures
MCOTS	Modified Commercial Off-the-Shelf
MCS	Mission Control System
MDA	Milestone Decision Authority
MDD	Materiel Development Decision
MDAP	Major Defense Acquisition Program
M-Demo	Maintainability Demonstration
MER	Manpower Estimate Report
MESM	Mission Essential Subsystem Matrices
MFHBA	Mean Flight Hours Between Abort
MFHBF	Mean Flight Hours Between Failure
MFHBFA	Mean Flight Hours Between False Alarms
MFHBOMF	Mean Flight Hour Between Operational Mission Failure
MFHBUMA	Mean Flight Hour Between Unscheduled Maintenance Action
MHLD	Maritime Homeland Defense
MIDS	Multifunctional Information Distribution System
MILCON	Military Construction
MILPERS	Military Personnel
MILSATCOM	Military Satellite Communications

MIL-STD	Military Standard
MIO	Maritime Interdiction Operations
MLDT	Mean Logistics Delay Time
MMA	Multi-Mission Maritime Aircraft
MNS	Mission Needs Statement
MOA	Memorandum of Agreement
MOB	Main Operating Base
MOCC	Mobile Operations Command Centers
MOCCRON	Mobile Operations Command Center Squadron
MOE	Measure of Operational Effectiveness
MOOTW	Military Operations Other Than War
MOPP IV	Mission-Oriented Protection Posture IV
MOS	Measures of Operations Sustainability
MOSA	Modular Open Systems Approach
MOU	Memorandum of Understanding
MP	Mission Payload
MPRF	Maritime Patrol and Reconnaissance Force
MPT	Manpower, Personnel, and Training
MRC	Maintenance Requirement Card
MRTFB	Major Range and Test Facility Base
MS	Milestone
MSD	Material Support Date
MSDS	Material Safety Data Sheet
MSO	Mission Systems Operator
MST	Mission Systems Trainer
MTA	Maintenance Task Analysis
MTBF	Mean Time Between Failures
MTBFA	Mean Flight Hours Between False Alarm
MTBOMF	Mean Time Between Operational Mission Failures
MTOGW	Maximum Takeoff Gross Weight
MTS	Maritime Target Set
MTTI	Mean Time to Intercept
MTTR	Mean Time to Repair
Multi-INT	Multiple Intelligence
MUOS	Mobile User Objective System

N

N/JMETL	Navy/Joint Mission Essential Task List
NADEP	Naval Air Depot
NAE	Naval Aviation Enterprise
NALCOMIS	Naval Aviation Logistics Command Management Information System
NAMP	Naval Aviation Maintenance Program
NAS	Naval Air Station
NATEC	Naval Air Technical Data and Engineering Services Command
NATO	North Atlantic Treaty Organization
NATOPS	Naval Aircraft Training and Operating Procedures Standardization
NAVAIR	Naval Air Systems Command
NAVAIRINST	NAVAIR Instruction
NAVAIRSYSCOM	Naval Air Systems Command
NAVSEA	Naval Sea Systems Command
NAVSUP-WSS	Naval Systems Supply Command—Weapon Systems Support
NAWC-AD	Naval Air Warfare Center—Aircraft Division
NAWC-WD	Naval Air Warfare Center—Weapon Division
NB	Narrow Bandwidth
NCA	Networked Communications Architecture
NCOW	Net-Centric Operations Warfare
NCTE	Naval Continuous Training Environment
NCTSI	Navy Center for Tactical Systems Interoperability
NDI	Nondevelopmental item
NECC	Net-Enabled Command Capability

NEO	Noncombat Evacuation Operations
NEPA	National Environmental Policy Act
NETS	Navy Engineering and Technical Services
NFC	Numbered Fleet Commander
NIPRNET	Navy Internet Protocol Router Network
NM	Nautical Miles
NMCI	Navy Marine Corps Internet
NMS	National Military Strategy
Non-ELORA	Noneconomic Level of Repair Analysis
NR	Net Ready
NR-KPP	Net-Ready Key Performance Parameters
NRT	Near Real Time
NSN	National Stock Number
NSS	National Security Systems
NSS	National Security Strategy
NTSP	Navy Training Systems Plan
NWAD	Naval Warfare Assessment Division
NWCF	Navy Working Capital Fund

O

O&M	Operations and Maintenance
O&S	Operations and Support
OA	Operational Assessment
OAAT	Open Architecture Assessment Tool
OCONUS	Outside the Continental United States
ODS	Ozone Depleting Substances
OEM	Original Equipment Manufacturer
OFT	Operational Flight Trainers
OIPT	Overarching Integrated Product Team
OJCS	Office of the Joint Chiefs of Staff
OJT	On-the-job training
OMF	Operational Mission Failures
ONR	Office of Naval Research
OOMA	Optimized Organization Maintenance Activity
OOTW	Operations Other Than War
OPAREA	Operational Area
OPCON	Operational Control
OPEVAL	Operational Evaluation
OPF	Operational Flight Program
OPNAV	Chief of Naval Operations
OSA	Open Systems Architecture
OSD	Office of the Secretary of Defense
OSHA	Occupational Safety and Health Administration
OSJTF	Open Systems Joint Task Force
OT	Operational Test
OT&E	Operational Test and Evaluation
OTA	Operational Test Agency
OTR	Over the Road
OTRR	Operational Test and Readiness Review
OUSD	Office of the Under Secretary of Defense

P

P2	Pollution Prevention
P&P	Preservation and Packing
PACOM	Pacific Command
PART	Program Assessment and Rating Tool
PB	President's Budget
PBA	Performance Based Agreement
PBIT	Periodic Built-in-Test
PBL	Performance-Based Life-Cycle Product Support

PBSS	Performance-Based System Specification
PC	Prime Contractor
PCA	Physical Configuration Audit
PCC	Printed Circuit Card
PCR	Physical Configuration Review
PD	Production and Development
PDF	Printable Document Format
PDM	Phased Depot Maintenance
PDR	Preliminary Design Review
PE	Program Elemetn
PEDD	Portable Electronic Display Device
PEM	Program Element Monitor
PEO	Program Executive Office
PEO (W)	Program Executive Office (Weapons)
PESHE	Programmatic Environmental Safety & Health Evaluation
PHA	Preliminary Hazards Analysis
PHL	Preliminary Hazards List
PHM	Prognostics and Health Management
PHMS	Prognostics and Health Monitoring System
PHS&T	Packaging, Handling, Storage, and Transportation
PIPC	Property in Possession of Contractors
PL	Public Law
PM	Program Manager
PM	Preventive Maintenance
PMA	Program Manager, Air
PMO	Program Management Office
PM-UCAS	Program Manager-Unmanned Combat Aircraft System
POA&M	Plan of Action and Milestones
POM	Program Objective Memorandum
POP	Performance-Oriented Packaging
PPA	Pollution Prevention Act
PPBE	Planning, Programming, Budgeting, and Execution
PPL	Provisioning Parts List
PPP	Public-Private Partnership
PPSP	Post-production Support Planning
PSC	Prime System Contractor
PSE	Peculiar Support Equipment
PSI	Product Support Integrator
PSICP	Program Support Inventory Control Point
PSM	Product Support Manager
PSP	Product Support Provider
PSQMD	Preliminary Squadron Manning Document
PSR	Program Support Review
PSS	Product Support Strategy
PTD	Provisioning Technical Documentation
PUMAS	Persistent Unmanned Maritime Airborne Surveillance
PWBS	Program Work Breakdown Structure
PWS	Performance Work Statement

Q

QA	Quality Assurance
QDR	Quadrennial Defense Review
QQPRI	Qualitative and Quantitative Personnel Requirements Information

R

R&I	Removal and Installation
R&M	Reliability and Maintainability
RAM	Reliability, Availability, and Maintainability
RAM	Random Access Memory
RBS	Readiness Based Support
RCM	Reliability-Centered Maintenance
RCS	Radar Cross Section
RDT&E	Research, Development, Test and Evaluation
RFA	Request for Action
RFI	Request for Information
RFI	Ready for Issue
RFID	Radio Frequency Identificatio
RFP	Request for Proposal
RFW	Radio Frequency Weapons
RLA	Repair-Level Analysis
RM	Requirements Management
RMB	Risk Management Board
RMCB	Risk Management Coordination Board
RMD	Resource Management Decision
RMDE	Risk Management Data Exchange
RMP	Risk Management Plan
RMRB	Reliability/Maintainability Review Board
RMS	Reliability, Maintainability, and Supportability
RNP/RNAV	Required Navigation Performance/Area Navigation
RO	Requirements Officer
ROMO	Range of Military Operations
RPV	Remotely Piloted Vehicle
RSTA	Reconnaissance, Surveillance, and Target Acquisition
RVSM	Reduced Vertical Separation Minimum
RWC	Radar Warning Capability

S

S&S	Support and Sustainment
SA	Supportability Analysis
SA	Situational Awareness
SA/LMI	Supportability Analysis/Logistics Management Information
SAG	Surface Action Group
SAM	Surface-to-Air Missiles
SAMP	Software Acquisition Management Plan
SAR	Search and Rescue
SAS	Supportability Analysis Summaries
SATCOM	Satellite Communications
SBIT	Startup Built-in-Test
SCIF	Sensitive Compartmented Information Facilities
SCN	Specification Change Notice
SCORE	Southern California Offshore Range
SCORM	Sharable Content Object Reference Model
SDL	Systems Development Laboratory
SDOE	System Design for Operational Effectiveness
SDP	Software Development Plan
SE	Sustaining Engineering
SE	Support Equipment
SE	Systems Engineering
SEAD	Suppression of Enemy Air Defenses
SECL	Support Equipment Consolidation List
SECNAV	Secretary of the Navy and Marine Corps
SEI	Software Engineering Institute

SEIT	Systems Engineering and Integration Team
SEMP	System Engineering Management Plan
SEP	Systems Engineering Plan
SEPO	Support Equipment Program Office
SERD	Support Equipment Recommendation Data
SERMIS	Support Equipment Requirement Management Information System
SES	Senior Executive Service
SETR	Systems Engineering Technical Review
SFR	System Functional Review
SHORECAL	Shore-based Consolidated Allowance List
SIGINT	Signals Intelligence
SIL	Systems Integration Laboratory
SINAD	Signal to Noise and Distortion
SIPRNET	Secret Internet Protocol Router Network
SIPT	Supportability IPT
SLOC	Source Lines of Code
SLRG	Senior Leader Review Group
SME	Subject-Matter Experts
SOA	Service-Oriented Architecture
SOE	System Operational Effectiveness
SOO	Statement of Objectives
SoS	System of Systems
SOW	Statement of Work
SPI	Special Packaging Instructions
SPTD	Supplementary Provisioning Technical Documentation
SQMD	Squadron Manning Document
SRA	Shop Replaceable Assembly
SRB	Specification Review Board
SRDR	Software Resources Data Report
SRR	System Requirements Review
SRT	Software Trouble Reports
SRVM	Specification Requirement Verification Matrix
SS	Support System
SSA	Source Selection Authority
SSC	Surface Surveillance and Control
SSG	Surface Strike Group
SSMP	Supply Support Management Plan
SSPP	System Safety Program Plan
SSRA	Sub-Shop Replaceable Assembly
SSWG	System Safety Working Group
ST&E	System Test and Evaluation
ST/STE	Special Tooling/Special Test Equipment
STANAG	Standardization Agreement (North American Treaty Organization)
STAR	System Threat Assessment Report
STE	Special Test Equipment
STOM	Ship-to-Objective Maneuver
SUW	Surface Warfare
SW	Software Engineering
SWaP	Source, Weight, and Power
SYSCOM	Systems Commands

T

T&E	Test and Evaluation
T&R	Training and Readiness
TAA	Team Assignment Agreement
TACON	Tactical Control
TAV	Total Asset Visibility
TCA	Threat Capabilities Assessment
TCCD	Training Course Control Document
TCDL	Tactical Common Data Link
TDFA	Top-Down Functional Analysis
TDP	Technical Data Package
TDS	Technology Development Strategy
TECHEVAL	Technical Evaluation
TELE	Target Location Error
TEMP	Test and Evaluation Master Plan

TEMPEST	Transient Electro-Magnetic Pulse Emanation Standard
TIM	Technical Interchange Meeting
TLCSM	Total Life-Cycle Systems Management
TLE	Target Location Error
TM	Telemetry
TM	Technical Manual
TMCR	Technical Manual Contractor Requirements
TMER	Technical Manual Evaluation Record
TMMT	Technical Manual Management Team
TOC	Total Ownership Cost
TOI	Targets Of Interest
TOL	Tailored Outfitting List
TPD	Technical Provisioning Data
TPDR	Technical Publication Deficiency Report
TPM	Technical Performance Measurement
TPMC	Technical Planning, Monitoring, and Control
TPS	Test Program Set
TRA	Technology Readiness Assessment
TRL	Technology Readiness Level
TRPPM	Training Planning Process Methodology
TRR	Test Readiness Review
TS	Training System
TSC	Tactical Support Center
TSE	Total System Error
TSPR	Total System Performance Requirement
TTP	Tactics, Techniques, and Procedures

U

UA	Unmanned Aircraft
UAT	Unmanned Aircraft Team
UCAS	Unmanned Combat Aircraft System
UID	Unique Identification
UII	Unique Item Identifier
ULSS	User's Logistics Support Summary
U.S.C.	United States Code
USD	Under Secretary of Defense
USD(AT&L)	Under Secretary of Defense for Acquisition, Technology and Logistics

V

VAMOSC	Visibility and Management of Operating and Support Costs
VAMS	Vibration Analysis and Monitor Subsystem
VCD	Verification of Correction of Deficiencies
VCJCS	Vice Chairman of the Joint Chiefs of Staff
VV&A	Verification Validation and Accreditation

W

WAA	Work Assignment Agreements
WARM	Wartime Reserve Mode
WB	Wide Bandwidth
WBS	Work Breakdown Structure

Web References

DoD Integrated Product Support Roadmap Tool	*https://dap.dau.mil/dodpsroadmap/Pages/Default.aspx*
Defense Acquisition Portal	*https://dap.dau.mil*
Integrated Life Cycle Chart	*https://ilc.dau.mil*
Title X, United States Code	*http://www.law.cornell.edu/uscode/usc_sup_01_10.html*
Product Support Manager's Guidebook	*https://acc.dau.mil/psm-guidebook*
Integrated Product Support Elements Guidebook	*https://acc.dau.mil/ips-guidebook*
Life Cycle Sustainment Plan Outline	*https://acc.dau.mil/lcsp-outline*
Defense Acquisition Guidebook	*https://dag.dau.mil/Pages/Default.aspx*
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